JANUARY, 1953

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

K.P.

In This Issue:

LOCATION GAGES
Their Design and Use

•

DIE QUENCH
Saves Dollars

•

HE PLASTIC MODEL
s an Engineering Tool

•

Principles of Cutting
heet and Strip Metal
with PRESS DIES

•

How to Select
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MATERIAL
for Automatic
EW MACHINE WORK

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ST CONTROLS OFFER
ncreased Productivity
Dollar Economies
ess Scrap and Waste

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ARDNESS TESTING
uipment and Methods

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NEWS OF
People
Products
Plants
and
Processes

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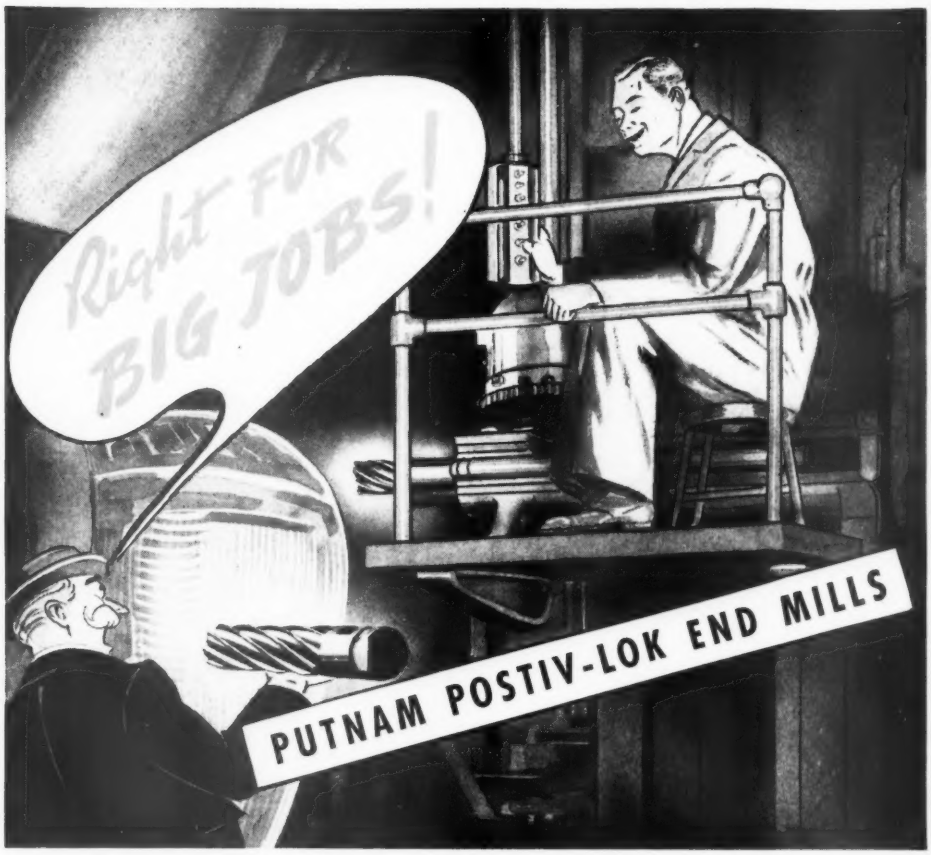

Three Reasons Why

1 Reduce set-up and change-over time required on large tapered shank tools.

2 Versatility — drilling, reaming and other operations can be done with same set-up, using Postiv-Lok adapters.

3 Eliminate need of integral tapered shanks. Tools cost less.

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RADIUS FORMING TOOLS

"TRU-LINE" PROFILE DRESSING TOOLS

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"STRAIGHT-SIX" DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS

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DIAMOND TOOLS—*Engineered to your Job*

NEW DIAMOND GRIT TOOL

makes big cut in thread grinding costs.

After two years of laboratory work and extensive production line testing we are happy to announce another important Wheel Trueing original—our new Diamond Grit Tool for dressing V and straight line form thread grinding wheels.

This new tool is a saturated concentrate of pure, sharp diamond grits in a special alloy matrix which wears so that there are always sharp grits exposed, giving effective cutting until the tool is used up.

Lighter dresses are effective, wheel life is increased and more pieces are produced per dressing. Remarkable savings have been demonstrated, one world known corporation reporting a projected annual saving in five figures.

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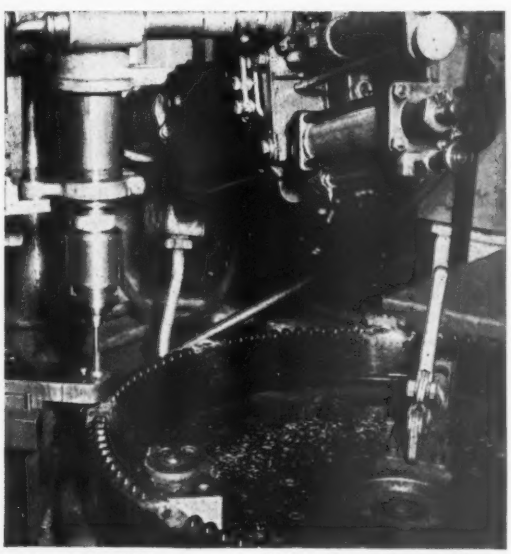
HOTPOINT, INC., MAKE IMPORTANT SAVINGS

In "Controlled-Air-Power" Drilling & Tapping Operations



If you'd like a copy of the Foto Facts File describing this operation at HOTPOINT, INC., write The Bellows Co., Dept. TP-153 Akron 9, Ohio. Ask for Foto Facts File FF-51-622.

Cuts labor cost from 33-6/10c to 7-3/10c each in drilling and tapping a heavy cast iron ring

THE makers of the famous HOTPOINT appliances watch costs as carefully as they guard quality. They pay particular attention to "second operation machining" for here they know substantial cost savings can be made.

Tool room ingenuity, coupled with Bellows "Controlled-Air-Power" Devices, have paid big dividends at HOTPOINT. Take, for instance, the set-up shown above. This special machine, built in their own tool room, combines two standard drill press heads, two Bellows electrically controlled drill press feeds and an electrically controlled Bellows Rotary Feed Table. It cut labor costs in drilling and tapping 8-¼" holes in a 25# cast iron ring more than 70%.

The story is typical of the experiences of thousands of manufacturers, large and small, in all lines of industry. No matter what you make, chances are Bellows "Controlled-Air-Power" Devices can help you make it quicker — at at less cost.

The Bellows Co.

AKRON, OHIO

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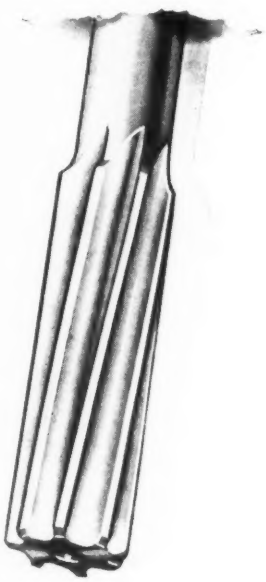
The Finest in Quality Reamers



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The Reamer Specialists

LAVALLEE & IDE, INC.

CHICOPEE, MASS.

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

Vol. VXIII, No. 10 JANUARY, 1953

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TOOLING and PRODUCTION'S great appeal is to those men who operate the plants and divisions of industry, their production departments and their toolrooms. It is they who collectively are charged with the responsibility of manufacturing their companies' products precisely, efficiently and profitably.

They have the influence that enables them to adopt the ideas and the processes which TOOLING and PRODUCTION describes in every issue AND the authority to recommend, to specify and/or to buy everything that may be needed to reduce costs, increase production or improve quality. These men for whom, each month, our editors seek out or write TOOLING and PRODUCTION'S meticulously accurate stories of "Know-How" and "Tell-How are T & P's exclusive Cycle of Buying Influence (CBI) in their plants.

Every copy is directed to these men by name, by title and by company address. Please see our CCA verification.

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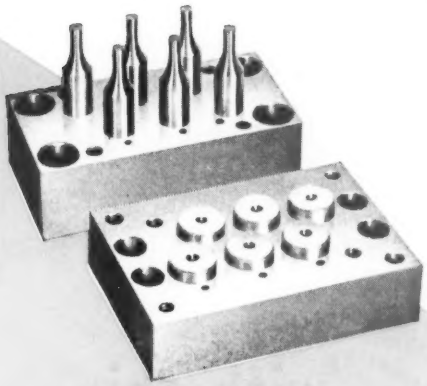
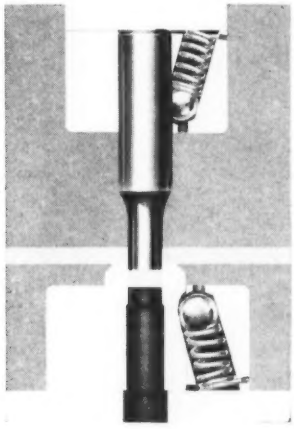
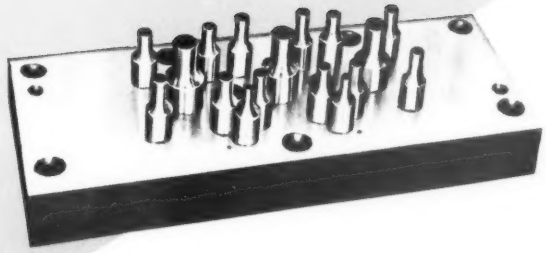


Gain time in die construction, plus all the advantages of standardized R-B features, where close spacing of punches is necessary and standard individual R-B retainer plates cannot be used—R-B will make special retainer plates holding multiple punches and die buttons to your exact specifications.

Each special R-B retainer plate is made from tool steel and all holes are precision ground after hardening—retainers are ready for mounting on your punch and die shoes without further machining and will save many of your skilled man hours in die construction and maintenance.





Standardized R-B ball locks are built into each special retainer to provide punches and die buttons with the same radial alignment, vertical locking and speed of insertion or removal obtained with standard R-B retainers.

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ALLIED PRODUCTS CORPORATION
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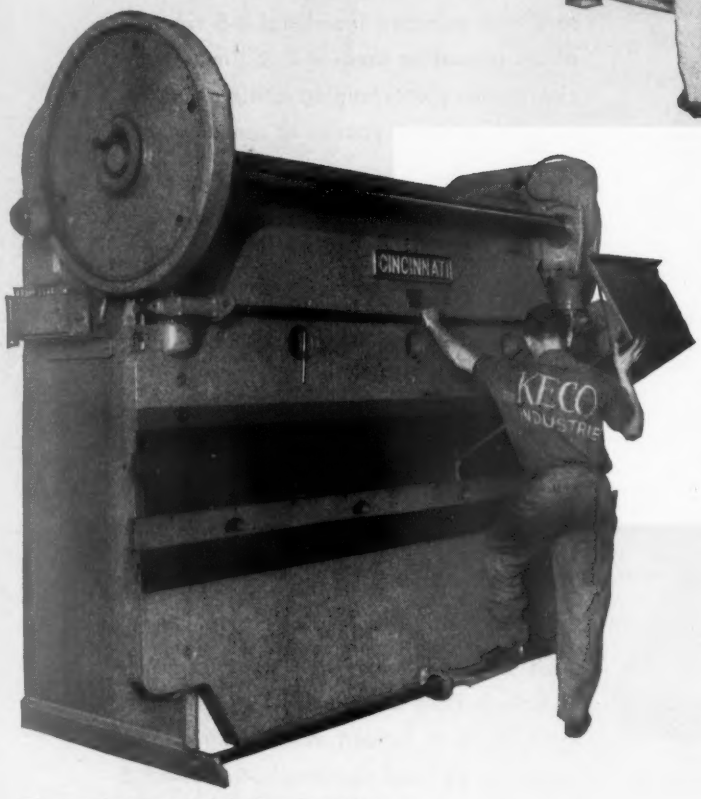
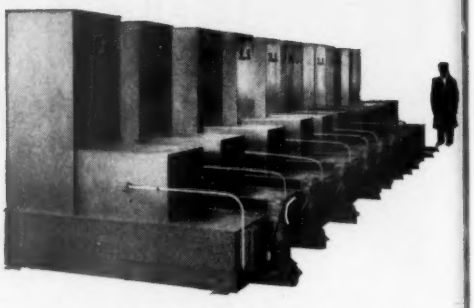


Photographs courtesy of the Keco Industries, Cincinnati 25, Ohio

with this CINCINNATI team



Cooling towers for portable air conditioning units

The floor-to-floor time consumed in shearing and forming panels for air-conditioning units, was cut from 12 minutes to 4 minutes at Keco Industries, using a Cincinnati Brake and a Cincinnati Shear.

Accuracy and rapid handling effected these savings.

In your shop, there may be opportunity for real costs reductions. Investigate Cincinnati Shears and Cincinnati Press Brakes.

Write for Cincinnati Shear Catalog S-6 and Cincinnati Brake Catalog B-3.

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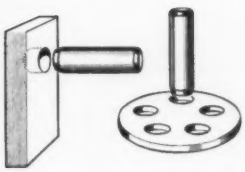
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

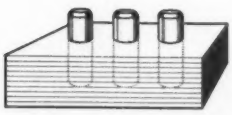
UNBRAKO PRECISION-GROUND ALLOY STEEL DOWEL PINS feature the following: formed ends which won't chip; 60-62 Rockwell "C" Scale surface hardness; 6 micro-inch maximum surface finish; 50-54 Rockwell "C" Scale core hardness; 150,000 psi average single shear strength; ±0.0001" diameter tolerance; 2 standards—blue label pins, .0002" oversize for nominal press fit requirements and red label pins, .001" oversize for use as repair pins.

Our Fiftieth Year

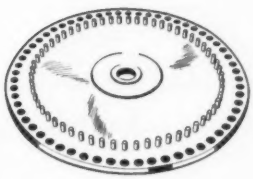
A START FOR THE FUTURE



Use UNBRAKO Dowel Pins as plug gages in various production operations, as guide pins, as stops, as wrist pins, hinges and shafts.



As fasteners for laminated sections, machine parts. As roller bearings in casters, truck wheels, etc.



As position locators on indexing machines, for aligning parts, as feeler gages in assembly work, as valves and valve plungers on hydraulic equipment.

See your distributor for UNBRAKO standards

You save time and money ordering UNBRAKO socket screw products from your UNBRAKO industrial distributor. He has a complete stock, offers excellent service and prompt deliveries. Write for UNBRAKO Standards. SPS, Jenkintown 36, Pa.

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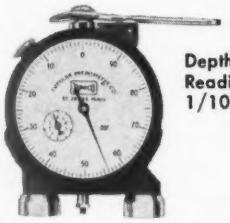


Depth Gage. Readings to 1/1000th.

1" Range Dial Indicator. Adaptable to many tools. Readings to 1/10,000th.

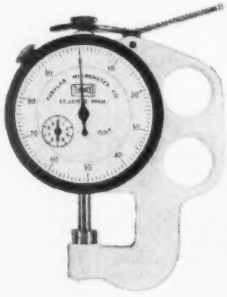
When your production must be held to close tolerances there's a Tumico Dial Indicator gage that will make high speed, accurate inspections. High visibility dials give instant and accurate readings. Our complete and diversified line may provide exactly the right type of dial indicator gage to best speed and insure accurate inspections.

Let our engineers examine your product inspection problem. Write for new catalog showing additional models.

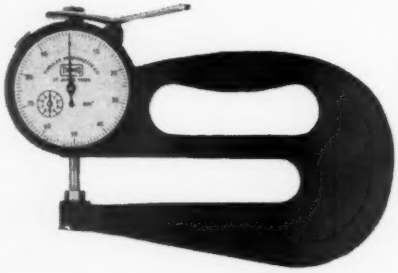
DIAL FOR ACCURATE

High Frequency Checking

1" Range Dial Indicator. Attaches to many tools. Readings to 1/1000th.



Lever Action Hand Thickness Gage with 1" Throat Depth. Readings to 1/1000th.



Lever Action Hand Thickness Gage with 4" Throat Depth. Readings to 1/1000th.

"Quality Control" of production lines can often be improved and speeded up by frequent spot checking with Tumico Dial Indicator hand and bench gages. High visibility assures quick, accurate readings to check vital production points.

Our production engineering department may be able to help you. Write us your problem. Our recommendations and complete catalog showing gages not illustrated will be sent promptly.

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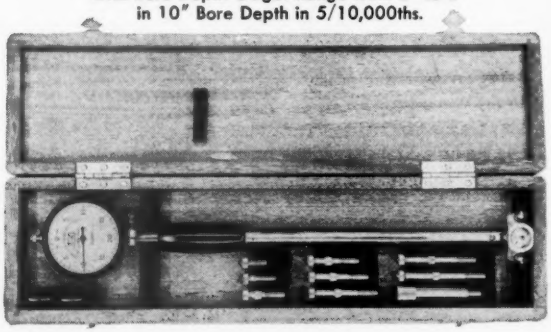
Dial Bore Depth Gage. Range from 2" to 6" in 10" Bore Depth in 5/10,000ths.



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. . . is proof of the superiority of

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"Mr. Big"- being completely free of harmful carbide segregation is proof that a positive control exists for eliminating segregation.

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To tool and die steel users "DESEGATIZED" means greater machinability . . . extra toughness . . . more uniform response to heat treatment . . . in short, a better tool or die.

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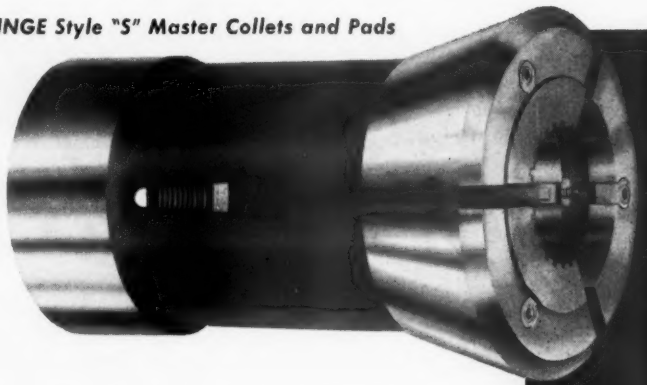
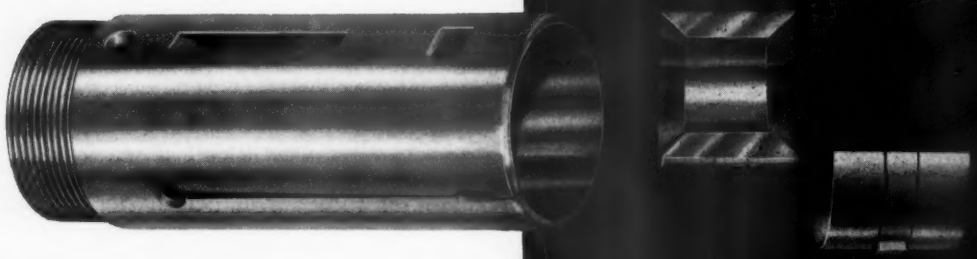


The Only MASTER COLLET
With No Work Pressure
on the Screw.

Pads Cannot Work Loose
No Screws No Pins

HARDINGE Style "B" Master Feed Fingers and Pads



Pads interchange with Masters for different makes of machines having the same capacity.

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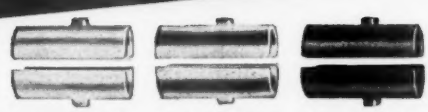
HARDINGE Master Feed Fingers with Adjustable Tension - provide tension change to suit varying requirements.

To decrease tension, turn sleeve

To increase tension, turn sleeve



Bronze Pads Steel Pads Cast Iron Pads

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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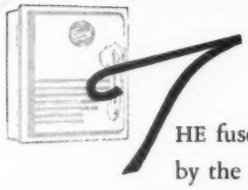
teamed precision of die and

PRODUCTO DIE SET

makes this intricate job possible



THE fuse terminal, shown below, is produced by the Federal Electric Products Co. for use in their Noark front operated safety switch. A Producto Die Set was selected to maintain the precise production of a top quality die at high speed operation.

Material is half hard 3/32″ copper (Rockwell 30-40 B scale), automatically fed to a Niagara 40 ton press. The progressive die stations are 1) pierce and stamp, 2) notch, 3) lance and emboss, 4) form 5) finish form. Die is held to extremely close tolerances. Production: 4000 pieces (1-3/16″ x 2-1/8″) per hour, 70,000 between grinds.

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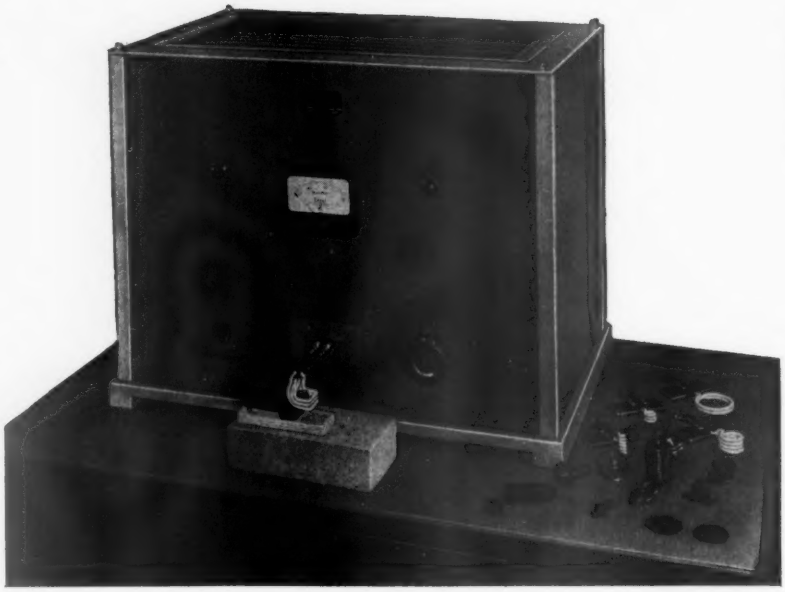

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Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

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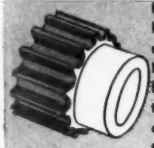
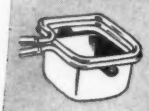
Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.



SOLDERING

Speedily and neatly performs intricate soldering applications with or without the use of pre-formed rings.

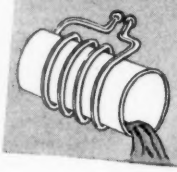


ANNEALING

Ideal for annealing, stress-relieving, normalizing or preheating selected areas.

MELTING

Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.



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- **FULLY GUARANTEED** Guaranteed for continuous duty cycle and stated performance.

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Complete unit with line connection and load coil.

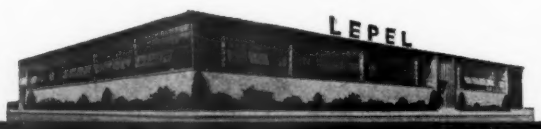
$870.

f.o.b. factory

WILL HEAT TO 1500° F.

⅛"	steel rod	1"	length	in	approx.	1	second
¼"	"	"	"	"	"	3	seconds
½"	"	"	"	"	"	15	seconds
1"	"	"	"	"	"	60	seconds

Will melt 4 ounces of brass or steel in 4 minutes.
Equally well suited for heating of non-ferrous metals.



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5107 PACIFIC BLVD. LOS ANGELES 58, CALIFORNIA
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TRADE MARK

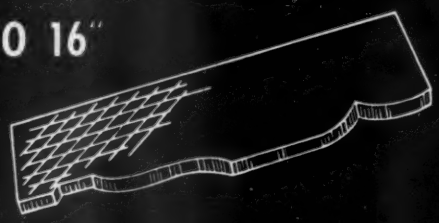
SPECIALIZING ONLY IN DRILL JIG BUSHINGS

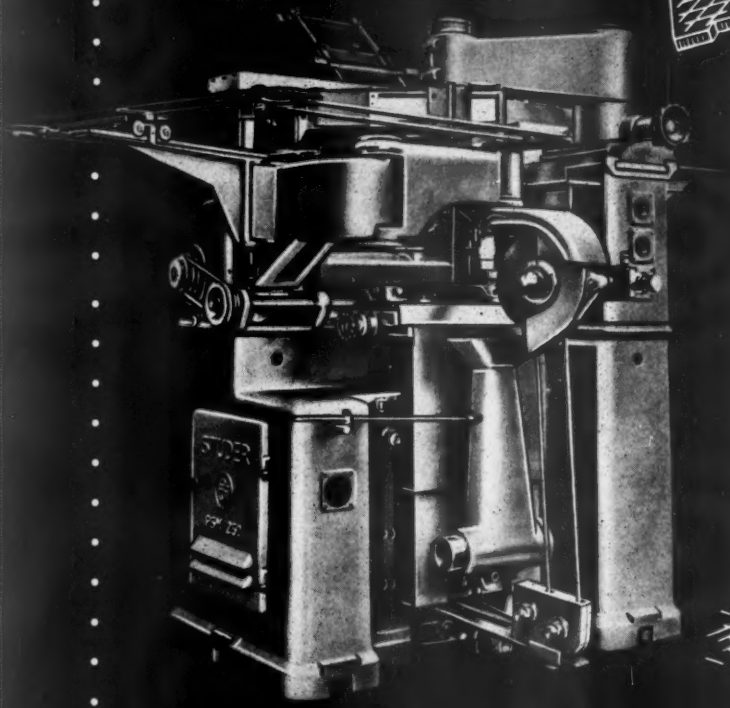
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

THE STUDER PSM-250

GRINDS PROFILES UP TO 16"

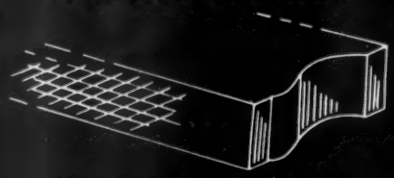
IN ONE SETTING





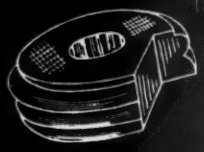
LARGER FLAT OR CIRCULAR FORM TOOLS, SECTIONAL DIES, GAUGES AND OTHER PROFILE PARTS CAN NOW BE ACCURATELY GROUND ON THIS

NEW STUDER
PROFILE GRINDER



INCREASED CAPACITIES
The PSM-250 grinds profiles up to 16" long in one setting and accepts flat work pieces up to 4¼" thick and rounds up to 10" diameter. Templates up to 24" long are easily accommodated. The adjustable pantograph can be set in any ratio from 1:1 to 1:10.

CLEARANCE ANGLE AND RELIEF GRINDING
Attachments are available to grind different clearance angles on flat form tools—*without correcting template form;* and, to relief-grind punching and drawing dies.



AUTOMATIC TRACER GUIDE
This attachment automatically guides tracer bar along the template. The automatic, uniform feeding produces improved surface finishes and increases the life of grinding wheels. To guide tracer bar by hand, two screws are loosened to detach the device.

PRECISE GRINDING
Profiles can be ground to a tolerance of ± 0.0004". Closer limits are obtainable when large ratios of reductions are employed.

WRITE FOR CATALOG ILLUSTRATING AND DESCRIBING THE NEW STUDER PSM-250

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

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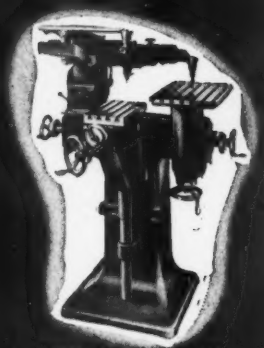
DECKEL

SYNONYMOUS WITH QUALITY

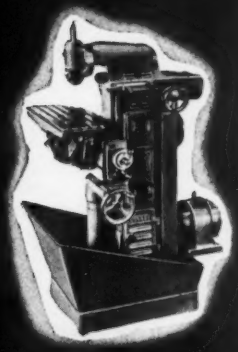
DECKEL MACHINE TOOLS universally recognized for Quality, Precise Production and Versatility. They can be used as single purpose machines for production or for multi-purpose operations in tool rooms and specialty plants.

Investigate all the advantages of DECKEL Universal Machines — Quality Tools at Lower Costs. In Stock For Immediate Delivery.

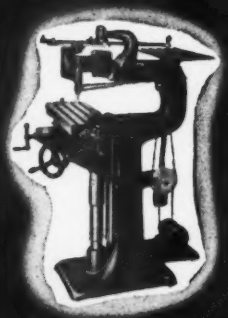


GK — 3-DIMENSIONAL ENGRAVER & COPY MILLER (2 Sizes) for fine engraving, embossing and copy-milling dies, molds, etc. up to 550 lbs. Reduction or enlargements from 1:1.5 to 1:10. Pre-loaded bearings in pantograph provide easy guidance, playless motion, minimize vibration. Larger machine has rough milling attachment.

FP 1 — UNIVERSAL MILLER (Horizontal and Vertical) for single jobs or production of tools, jigs, gauges, dies and molds. Micrometer measuring devices for jig boring. Attachments: Punch Milling, Spiral Milling, Vertical Milling Heads, Slotting Device, Fixed, Swivel or Circular Tables, Dividing Head.

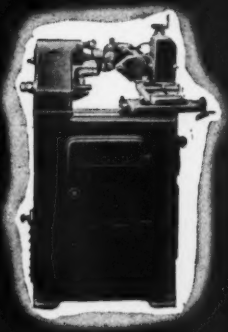


KF 1 — UNIVERSAL COPY MILLER for producing dies and molds up to 1100 lbs. With special accessories, the KF 1 provides greatest manufacturing economy. One handed 3 dimensional control. Ratio 1:1. Reduction and enlargement attachment has ratio from 1:1.5 to 1:7. Copy Table — 15 3/4" sq. Max. work piece height 17". Optical tracing mechanism. Circular milling attachment.

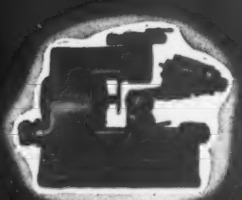


G 1 U — 2-DIMENSIONAL ENGRAVER for fine engraving and light milling. Ratios from 1:1 to 1:50. Light Pantograph with playless ball bearing joints provides easy guidance and accurate work.

S 1 — UNIVERSAL TOOL & CUTTER GRINDER for grinding spiral or straight fluted cutters, counterbores, countersinks, straight and taper reamers, taps, etc. Production grinding of high precision tools. Easy, convenient operation with utmost accuracy.



TYPE SON — SINGLE LIP CUTTER GRINDER indispensable for grinding and backing-off form cutters and tracing styluses used on the G 1 U, GK 12, GK 21, KF 1, FP 1. Can be operated quickly and accurately by unskilled workers.



SEE THESE MACHINES IN OPERATION AT COSA'S NEW YORK SHOW ROOM OR SEND FOR DESCRIPTIVE LITERATURE.

COSA CORPORATION

405 Lexington Ave., New York 17

Your source for all Precision Machine Tools — from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

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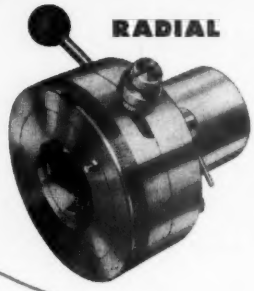
CUT BETTER THREADS AT LOWER COST!

RADIAL



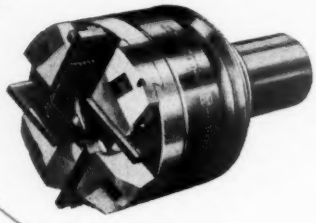
These Die Heads, with *ground thread* chasers, do an outstanding job on large or small lots, in pitches ranging from extremely fine to coarse multiple Acme.

They have an over-all capacity of from No. 8 to 4¼".

They require no more than the proper chasers to cut either right- or left-hand threads.

They are easy to install and simple to handle. For almost half a century of continuing development and improvement, J & L Dies and Chasers have been the answer to threading jobs throughout the world.

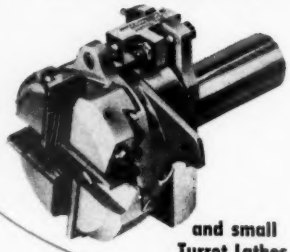
TANGENT



J & L Tangent Chaser Die Heads, with *ground thread* chasers, are rugged, dependable, time-tested tools. They are production engineered to produce better threads at speeds limited only by the material being threaded. Capacities are from No. 4 to 2".

There is a J & L Tangent Chaser Die Head engineered for your requirement. Stationary types are available for turret lathes or any machine where the tool does not turn. Revolving types are for automatic screw machines, drill presses, threading machines, or any machine where the tool is held in a live spindle.

For B&S AUTOMATICS and small Turret Lathes



For high production, quality threading on B & S Automatics and small turret lathes. Their simple design and careful workmanship assure repetitive accuracy with long runs between chaser grinds.

No. 16-S is for use on B & S No. 00, 00G, 0 and 0G and small turret lathes. They have "DUALIFE" radial type *ground thread* chasers with two cutting edges for maximum use between grinds.

No. 18-S is for B & S No. 0, 0G, 2 and 2G and the No. 19-S, with wider range, for B & S No. 2 and 2G. These dies use *ground thread* tangent type chasers.

P.S. *Write to Dept. 710 for catalog!*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 519 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L DIE HEAD DIVISION

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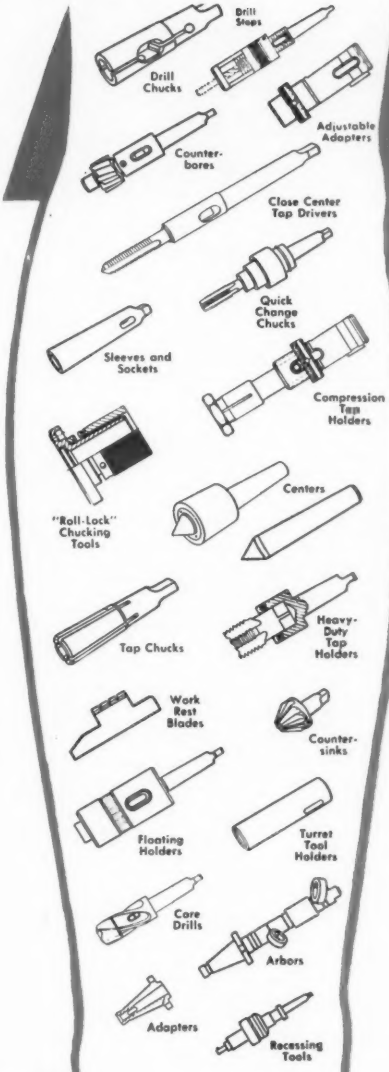


THE NEW CHUCKING TOOLS

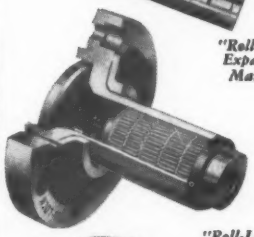
POWERFUL AND ACCURATE

. . . for precision work

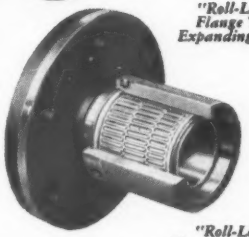
SCULLY-JONES

"ROLL-LOCK"* CHUCKING TOOLS

"Roll-Lock" Expanding Mandrel



"Roll-Lock" Flange Type Expanding Arbor



"Roll-Lock" Flange Type Chuck

"Roll-Lock" Mandrels, Arbors and Chucks use a new chucking method for holding work or tools. This method takes advantage of the elastic properties of metal.

When a very little turning force is applied to actuating ring or cone, the powerful wedging action of rollers expands or compresses the chucking surface to a shrink fit. This permits maximum torque and thrust to be transmitted, assuring accuracy often less than .0001". "Roll-Lock" Chucking Tools are engaged or disengaged quickly and easily. Yet the shrink fit cannot be loosened by reversing the rotation of the tools or by shock and vibration.

Shown to the right are two of the many applications in turning, grinding or inspection operations. "Roll-Lock" Flange Type Expanding Arbor and Tool Chuck being used in a finish grinding machine for holding the work and grinding tool.

**"Roll-Lock" is a trade mark of Scully-Jones and Company.*

WRITE FOR BULLETIN No. 17-50
giving detailed description and technical data on these and other "Roll-Lock" Chucking Tools.

Scully-Jones AND COMPANY

1913 Rockwell St., Chicago 8, Ill.

B-5828R

YOU GET LOW COST FAST ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

the "ARMS and HANDS" for your MACHINE TOOLS

If you think of a Lathe, Mill, Multi-Spindle Machine, or other Machine Tools as being a human body, supplying power to the parts of the body doing the actual work, then Scully-Jones tools represent the "Arms and Hands"

YOUR PROBLEMS ARE OUR PROBLEMS

Helping you solve your tooling and production problems is Scully-Jones first objective. Ever since 1912 we have designed, developed and manufactured tools to the highest standards to help you get fast, accurate production at low cost.

That is why you can purchase S-J Tools and get the best that engineering research, modern equipment, correct materials and expert workmanship can produce.

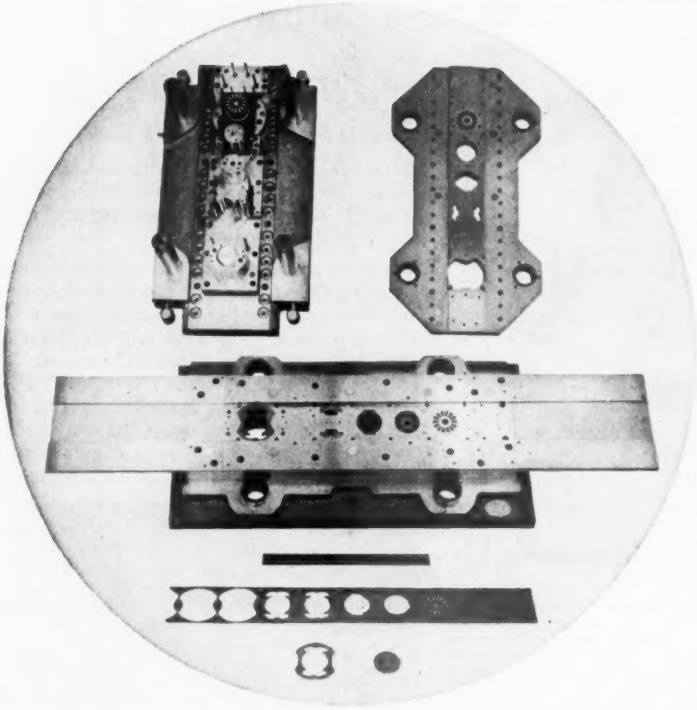
Use these S-J "Arms and Hands" to equip your machine tools. They will help you get low cost, fast, accurate production on such operations as drilling, reaming, tapping, milling, counterboring, countersinking, core drilling, recessing or undercutting, boring and grinding.

For current information on S-J Tools, refer to Catalog 600. Write on your company letterhead for your copy.

Let us help you solve your tooling and production problems. Because our manufacturing facilities have been expanded, we're in a position to give you reasonable deliveries. For quick service see our nearest representative or contact Scully-Jones direct.

This die was not just "made"...

it was ENGINEERED



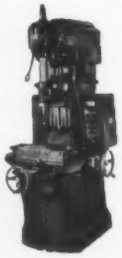
Just a choice of words, you say? No, it's more than that. The progressive steel lamination die shown here was hole-bored, hole-ground and contour-ground to pre-engineered dimensions entirely on Moore-built machines in the Moore toolroom. It exemplifies the application of *engineering* principles that put die-making on an interchangeable parts-and-assembly basis for the first time.

Let's take a close look at this die: All die sections are mounted in a hardened nickel-chrome frame for maximum production and die life; the die set was specially made by Moore. The spring stripper is guided on four main posts. High-speed inserts are set into hardened steel frames.

Moore produced all parts of the die *to figures instead of to "fit."* This was done concurrently by several toolmakers instead of progressively as a slow, one-man job.

Precision Hole Location and Contour Grinding Methods Assure Accuracy, Speed, Economy

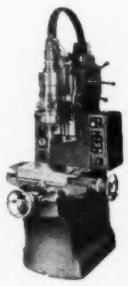
THE NO. 2 MOORE JIG BORER bored all holes before hardening, thus holding the location as close as possible to eliminate excessive grinding. With its built-in system of accurate lead screws, the Moore Jig Borer can spot, drill, bore or ream all holes in a workpiece with minimum tool changes and to close tolerances.



No. 2 MOORE JIG BORER

Punches and dies of the first station—at the right in the photograph—were ground with a *Moore Panto-Crush Wheel Dresser*. This machine, which combines roll-crushing and diamond dressing, did the required linear contour grinding quickly and efficiently. *Moore Motorized Centers* handled several of the smaller grinding jobs.

WITH THE NO. 2 MOORE JIG GRINDER, all die sections were screwed and doweled into place, put on the machine and ground in *one* set-up. This eliminated separate section hole-grinding and the accompanying difficulty of accurately locating each section in the die bed. The Jig Grinder does the job in one-third the time required by previous methods.



No. 2 MOORE JIG GRINDER

To grind Stations 2, 3, 4, 5 and 6, the new contour-grinding and slot-grinding features of the Jig Grinder were utilized.

Die try-out and assembly operations were performed the modern, fast, "mechanized" way on the *Moore Die Flipper*.

End results? Moore equipment brings true interchangeability to the toolroom, lowers tool costs, increases toolroom capacity, prolongs die life and achieves greater accuracy.

Detailed bulletins on these machines are yours for the asking—today. Write to: Moore Special Tool Company, Inc., 726 Union Avenue, Bridgeport 7, Conn.

ADD (MOORE TOOLS) TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS
DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

Do Dimensions over 10" give you trouble?

- No workpiece too large, infinite range.
- ID, OD or linear dimension inspected accurate to .000005".
- Patented clamps, jaws, center point, scriber and base offer wide gaging applications.
- Write for full description of HD Gage, Blocks and Fixtures.

Webber

HEAVY DUTY GAGE BLOCKS AND FIXTURES

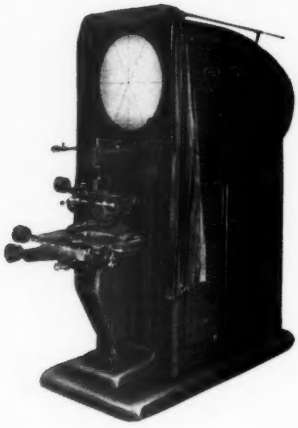
TEMP-CHECK

No need to wait for work to "cool off" before making critical inspection . . . tells temperature quickly. Write for literature.

WEBBER GAGE COMPANY
12903 Triskett Road, Cleveland 11, Ohio

which of these 3 optical aids answers Your PRECISION PRODUCTION PROBLEM?

1



CONTOUR MEASURING PROJECTOR—You save time and money by spotting inaccuracies quickly and simply . . . with higher precision measurements than any other projector can give you. You get angular measurements to ± 1 minute of arc with a protractor screen, and direct linear measurements to ± .0001″ over a range of 4″ by 6″ with the cross slide stage. Dimensions, angles and profiles of production-run parts can be compared directly with a *traced* outline of the projected image of the master part, or with a scale drawing superimposed on the screen. Write for Catalog D-27.

2

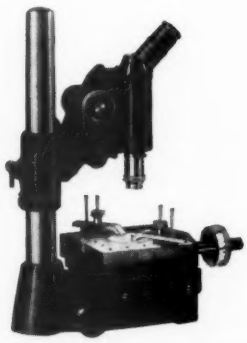
STEREOMICROSCOPES

The finest optical system ever produced for stereoscopic work assures you precision accuracy in small parts assembly operations and in inspection of tools and finished parts. You get clear, sharp, three-dimensional images, and a *wider critical focus than ever before.* The *unreversed,* magnified image is more easily interpreted by the average user. These sturdy, dustproof microscopes are extensively used in industry, either alone or incorporated into machine tools. Write for Catalog D-15.

1853/1953 INTO A NEW CENTURY OF OPTICAL PROGRESS
BAUSCH & LOMB CENTENNIAL

WRITE **for complete information on these three important optical aids designed to save you time and money. You may be paying many times over their moderate cost in lost time and rejects. Bausch & Lomb Optical Co., 79813 St. Paul St., Rochester 2, N. Y.**

3



TOOLMAKERS' MICROSCOPE

This sturdy microscope gives you one inch linear measurements to ±.0001″ and angular measurements (with protractor eyepiece) to ± 1 minute of arc. Operation is extremely *simple* and *fast.* Opaque and transparent objects of any contour can be measured. Catalog D-22.

B&L Bausch & Lomb *Quality Control* Instruments

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GREAVES MACHINE TOOL CO.

Cuts Boring Time on Columns 75% with BUNELL TOOLING

● The Greaves Machine Tool Company of Cincinnati, Ohio, a leading manufacturer of Milling Machines, has reduced the time required for boring their machine columns by 75% with Bunell Tooling.

● Greaves is also consistently obtaining a greater degree of precision and accuracy by the use of Bunell Boring Fixtures and Boring Bars (illustrated above). Time and labor savings like this speed production and help Greaves reduce costs and meet shorter delivery requirements of customers.

● Bunell's complete modern plant facilities and experienced engineering staff are available to help you with your tooling problems. Write for full information.

WRITE FOR FREE CATALOG which describes Bunell services, facilities and equipment.

THE BUNELL MACHINE & TOOL CO. CLEVELAND, O. BUNELL

BUNELL MACHINE AND TOOL CO.

1600 EAST 24th STREET • CLEVELAND 14, OHIO

Since 1920, Designers and Builders of Special Tools, Dies, Jigs, Fixtures and Special Machines

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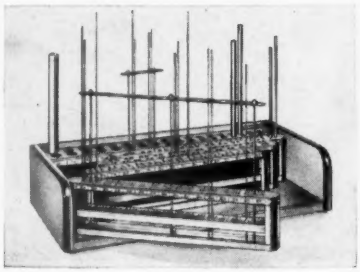
inexpensive

. . . Money Saving Accessories For Your Plant

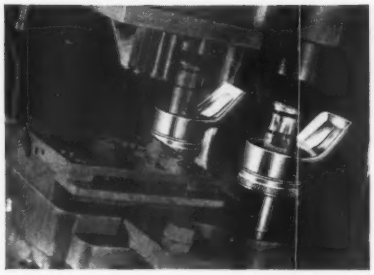
Each of the accessories illustrated and described below was designed and built for a definite need and used in our own plant before being offered to industry. They require a relatively small investment, yet will save you money every day. For further information, write for the folder offered below.

DRILL ROD RACK



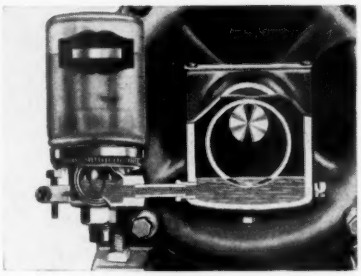
Eliminate trouble and waste effort with this modern method of storing drill rod. Put the Acro rack in a central location of each department and make it simple for each mechanic to select correct rod size in a hurry. It also provides a visual inventory for checking rod replacements.
Accommodates 26 letter sizes, 52 pieces; 47 fractional sizes, 138 pieces; 60 number sizes, 304 pieces. Fractional sizes graduated in 64ths from 1/32" to ½" and in 32nds from ½" to 1" included.

LEADER PIN OILERS



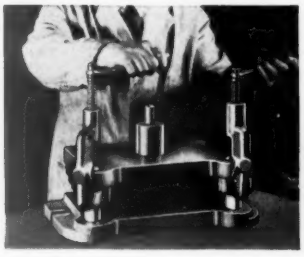
Eliminate wear on your die sets with these leader pin oilers. Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminate bushing wear, leader pin scoring, and maintains die accuracy. Die sets equipped with Acro Pin Oilers have run under tests for several weeks to a month without refilling.

AUTOMATIC LUBRICATORS

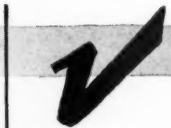


With this Acro lubricator, you can lubricate oil ring, capillary, ball or roller bearings on electric motors, blowers, lineshafts and similar bearings for periods as long as six months to one year with one filling. You can save 50 to 95 per cent in oil consumption, practically eliminate maintenance labor and burned out bearings due to faulty hand oiling and guesswork. In addition to savings effected in labor and maintenance, Acro lubricators soon pay for themselves in oil savings alone.

DIE SET PULLERS



The principle of the Acro Die Set Puller is to remove the punch holder from the die shoe by a straight upward pull, whereby punch holder travels upward from die shoe axially, leaving both leader pins simultaneously. This is accomplished only by use of the indexed screw wrenches which act as indicators, controlling the upward travel. This is an exclusive patented Acro feature, found only in Acro Die Set Pullers.



Free Data

covering each of these profitable accessories is included in our folder. Write for bulletin TP-52.

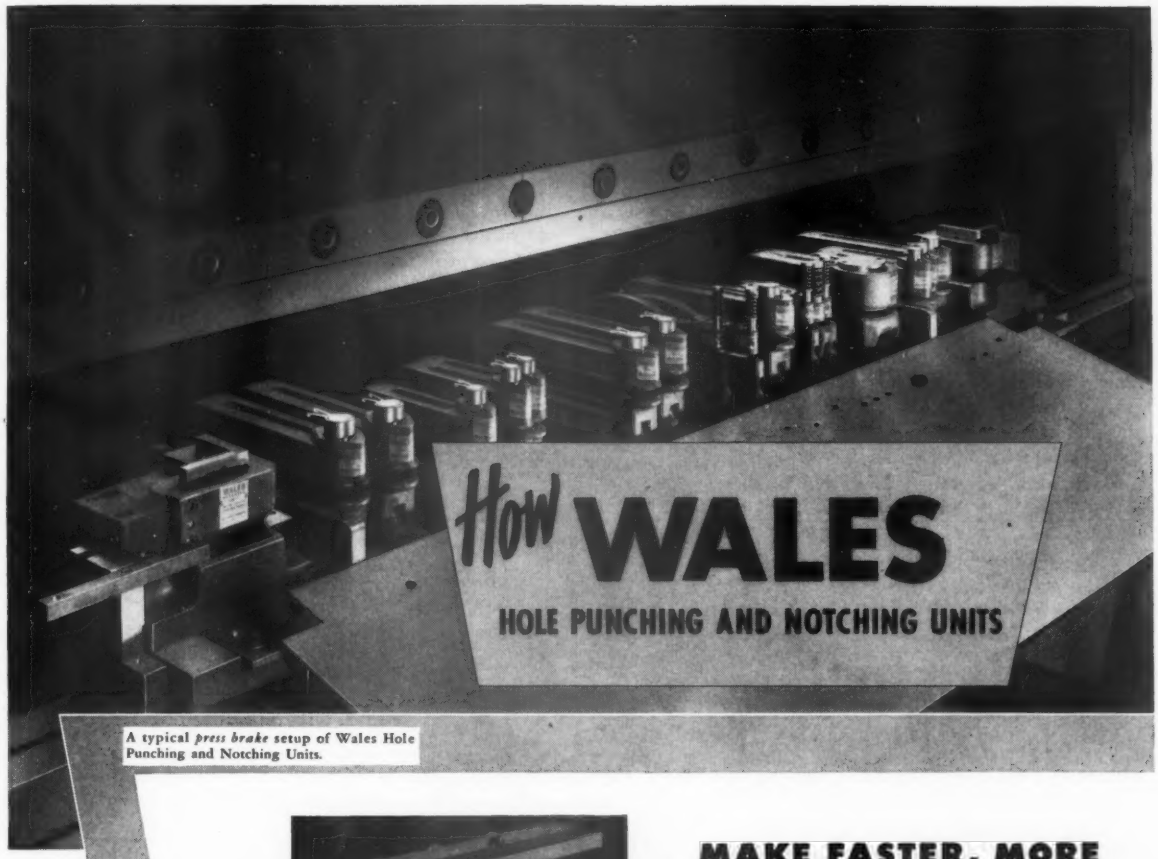
ACRO

METAL STAMPING CO.

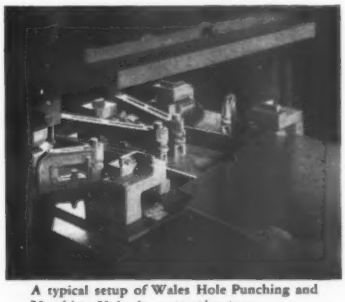
330 EAST RESERVOIR AVE.

MILWAUKEE 12, WIS.

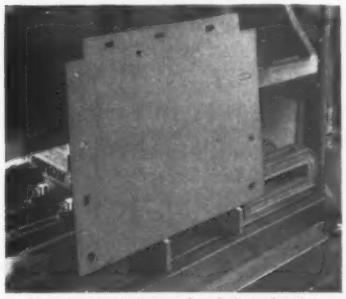
FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD



A typical *press brake* setup of Wales Hole Punching and Notching Units.



A typical setup of Wales Hole Punching and Notching Units in a *stamping press.*



Showing typical round and shaped holes punched by Wales Hole Punching Units. Note corners have been notched by Wales Notching Units.

MAKE FASTER, MORE ECONOMICAL SETUPS IN STAMPING PRESSES AND PRESS BRAKES

. . . *By eliminating* the time consuming operation of aligning each set of punches and dies.

. . . *By eliminating* special punches, punch plates, stripper plates, die buttons and die plates.

. . . *By eliminating* "dead storage" of setups and tooling investments—Wales Units drastically reduce setup and production time plus cutting initial and operating costs.

These tooling efficiencies are made possible by the *exclusive* independent, self-contained design that holds all working parts as a single hole punching or notching unit. A group of Wales Units may be set up in unlimited patterns and in many cases, put into operation the same day a pattern is released for production.

For the complete story on this faster, more economical production technique that has revolutionized tooling practice, write TODAY for fully-illustrated, functionally-colored Catalog BL and Catalog N.

WALES-STRIPPIT CORPORATION
GEORGE F. WALES, *Chairman*
355 PAYNE AVE., NORTH TONAWANDA, N. Y.
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO
Specialists in Punching and Notching Equipment

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

. . . . . The Publisher Looks

Our editorial staff's plans and commitments for 1953 are based upon two purposes truly inspirational in nature.

First is the inspiration engendered by our new large size and format. This is, in effect, a new showcase for the output of our editorial workers. It will permit them to really let themselves go as to illustrations, drawings, lay-out and artwork. Our articles will have more display which will make for easier reading and for better pictorial treatment of fine mechanical details. This all adds up to reader benefits in keeping with the services we are constantly striving to improve upon.

Second is the inspiration that derives from tangible evidence at hand that over the years we have attained a certain measure of accomplishment in making our magazine *TOOLING and PRODUCTION*, in itself, a valuable working tool. It is designed and produced with no other thought in mind.

Readers and advertisers have told us that:

"My monthly copy is circulated to (5) Production Planning Supervisors who in turn call attention to articles of interest to subordinates".

"The technical and shop articles that are published monthly are written by people who seem to know their business. They are not only well written but they are well illustrated and in several cases have solved some of our problems."

"You will be happy to note that *TOOLING and PRODUCTION* pulled more inquiries during 1951 than any other paper on our schedule".

"The back copies are kept on my book shelves in my office so that they are available for ready reference when needed."

". . . . the many ideas that we have gotten from reading your publication have been put into practice on a modified scale, and have been very helpful to us."

"You'll be glad to know that your book leads the list in volume of inquiries on the . . . schedule to date."

". . . . . and find that the magazine is both interesting and educational to me and my men."

"It seems that every issue contains something of value to me."

"To date we have received 33 direct requests compared to 28 requests through your service. However, in addition there have been many telephone contacts, most of which were long distance. Further, we find that your publication has been of more service to us than two others."

"It may interest you to know that *TOOLING and PRODUCTION* is being used very successfully and that we are now making use of several ideas that were published."

Now they are not speaking of so many ounces of paper and ink. They mean that they have been able to take the ideas, experiences, suggestions, precautions and instructions which have been relayed to them via our pages, and convert them into working tools or methods.

Remember your No. 1 Axiom from grade school geometry? "Two things that are equal to the same thing are equal to each other."

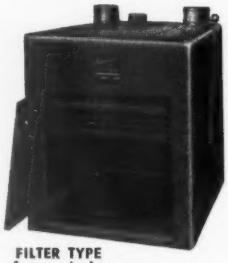
TOOLING and PRODUCTION is predicated on tooling and production, it conveys and demonstrates tooling and production, it is used where tooling and production are used, and it originates where tooling and production originate. Can't we say then with virtually mathematical certainty, that *TOOLING and PRODUCTION is* tooling and production? We think we can, and the many comments from readers lend a degree of assurance to this bit of mathematical fantasy.

Contributing greatly to the toolworthiness of *TOOLING and PRODUCTION* are the backgrounds of all

THE costliest cutting tool IN YOUR PLANT—

No — it's not a tool of production — it's a tool of destruction! . . . it is ABRASIVE GRIT — by-product of your grinding, cutting and finishing equipment.

CYCLONE TYPE for tool and general grinding, polishing, woodworking, plastics, glass, ceramics, etc.



FILTER TYPE for grinders, drills, lathes, surface grinders, etc.

Hammond DUSKOLECTORS

A MUST FOR DUST!

These units trap dangerous dust before it can harm the health and efficiency of your employees and damage valuable machinery . . . These two distinct types of Duskolectors offer the best and most economical solutions to your special dust problems. Hammond experience will help you too, in eliminating the dust menace . . . Write today for bulletin.

Hammond Machinery Builders INC.

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Hammond OF KALAMAZOO GOOD MACHINERY SINCE '82

at the Year Ahead . . . . . .

of our editorial staff members. They have brought to their jobs, many collective years of engineering experience gained since completing their formal schooling. This inventory of experience runs an imposing gamut of metal-working, including machine and tool design, mechanical and optical gage and instrument design and manufacture, and quality control. To our mutual advantage they "know the score" in tooling production.

Now, a word about our authors. You will note that the vast majority of our articles carry the names and titles of men in industry who enjoy recognizeably responsible positions. It is well known that writing for an industry publication is not a get-rich-quick proposition. What we gladly pay for their articles is simply in recognition of their willingness to take "time out", usually from their evening relaxation or hobby time, and set themselves to the task of compiling their know-how of a subject to share it with others.

We feel that they are deserving of all the recognition we can give them. We feel that you—one of our readers—appreciate the authenticity attached to an article prepared by one who is earning his "take-home" by practicing what he preaches. We know that correspondence frequently takes place between readers and author following the appearance of an article. We are confident, based on evidence, that the greatest aggregate benefits derive from such authentic personal presentation and more intimate and direct exchange of ideas.

We know that the tremendous progress and accomplishments that characterize our industry are due in great measure to the free and stimulating exchange of working ideas. We know that in other countries there still exist those old world tensions and petty jealousies between managements, between workers and between professions that mitigate against such mutual benefits as we have come to expect and take for granted. Invariably foreign visitors to our industries are amazed at our open-handedness, our willingness to show and share our know-how and techniques.

We are very confident that whatever your expectations may be regarding *TOOLING and PRODUCTION's* continuing value as a working tool, they will be more than fulfilled throughout 1953. I want it that way; our editors want it that way; and you want it that way.

Please accept my assurance that our editors always welcome your expressions of opinion. Your own work is your paramount interest. Your success and your knowledge have been gained the hard way. If you will recognize that satisfaction and pleasure are to be gained by sharing your know-how with others you are invited to correspond with our editors. You will meet with enthusiastic encouragement and co-operation to the end that your contributions may be published for the benefit of others and with recognition to you. Dollar-wise, our editors have a place in their budget for your efforts.

In conclusion, our appreciation of your valued support and acceptance can be best evidenced by our continuing efforts to be deserving.

To us, 1953 looks *good* on all counts. To you, our most sincere wishes for *all* that is *good* in the year ahead.

Sincerely,

Geo. J. Hubner

Publisher

Specify EX-CELL-O Precision Spindles
GRINDER MANUFACTURERS DO!
You can insure the accuracy of your grinding equipment as many grinder manufacturers do—by standardizing on Ex-Cell-O Precision Spindles. Prominent machine tool builders install Ex-Cell-O Spindles as original equipment on internal grinders, universal grinders, surface grinders, gear grinders, tool and cutter grinders and special-purpose grinders.
Select the grinding spindles you need from the big Ex-Cell-O Spindle Catalog. If you don't have a copy write for one today on your company letterhead. There is no obligation, of course.
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
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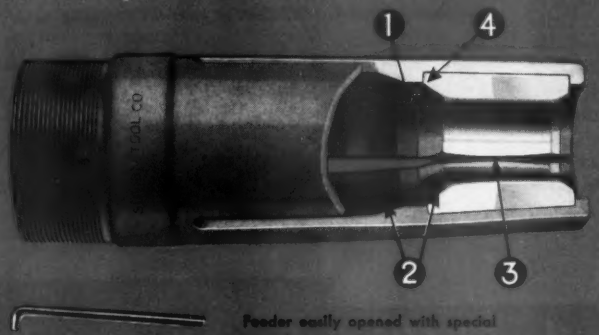
SUTTON
STYLE "L"
MASTER FEEDERS
lower production costs



Feeder easily opened with special wrench to insert or remove pads

1 Slot in master engages lug on one of the pads, preventing pads from rotating.

2 Tapers on pads and in master give proper lead and allow stock to enter easily.

3 Double angle on side of pad permits worn pad to be restored to gripping size.

4 Recess in master that receives pads and takes operating thrust. No screws or pins to vibrate loose.

NO PINS OR SCREWS

No pins or screws are necessary to hold the feeder pads in place. The pads are seated in a recess in the master and a lug on one of the pads engages a slot in the master and keeps the pads from rotating as shown in the cross section view.

COMPENSATION FOR WEAR

Each pad is made with a double angle on each side. Hole size of the pad can be restored by grinding down the points of the angles, allowing tension to bring the pad sections together. This reconditioning can be done many times.

SELECTIVE HEAT TREATMENT

The conventional solid feeder must be subjected to three different heat treatments within a length of 4 to 6 inches. This difficulty is overcome in the Style "L" by making the master separately from the gripping pads, which are made from steel selected for wear-resistance.

ONE MASTER PER SPINDLE

Style "L" Masters handle a range of stock practically up to machine capacity. One master and different sets of pads will take care of the full range of one machine. When pads are worn out, it is necessary to purchase only new pads for use in the original master.

Department TP-1, Sutton Tool Company, Sturgis, Michigan

SUTTON COLLETS

Top News for Top Management

"Business Under the Coming Administration"

Donald F. Carpenter, general manager of the Du Pont Film Department, said that a new administration in Washington provides American business and industry with "an opportunity" for constructive action but presents at the same time, heavy national responsibilities.

Speaking recently before the Manufacturers' Section, chamber of Commerce of Delaware, he told the members that business now hopes to have a government "characterized by integrity and fairness", but warned that business "will be distinctly on probation".

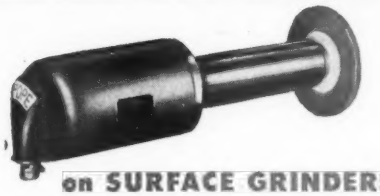
"We will be under minute observation on every side," he said. Business expects no special favors from the new administration, but hopes for fair treatment, "not fairness to the proprietor of a business alone, but fairness to all elements of society, whoever and wherever they may be.'

Business makes only one request of the new administration, he said. "Give us equality of opportunity and let us show you what we can do for this glorious country of ours. Let us practice the free enterprise systems and let it demonstrate again what miracles it can perform for all Americans. Let us also say, however, that if we are granted this request, we will pledge, in turn, not to abuse our opportunity.

"It is now time for us to show our statesmanship. We must not change from the hunted animal to the devouring beast—but rather we must emerge from behind the tree confident that we will not be fired upon by the first government agency that spots us. We must quietly, sincerely, and energetically carry on our duties like the true domesticated animal — the beast of burden if you like but the servant of our country."

Referring to attacks on business, Mr. Carpenter said, "For 20 long years we have been looked upon with suspicion. We have been

It's the SPINDLE That Does The Work



on SURFACE GRINDERS

specify **POPE P32-T** Direct Motorized Cartridge Type with strong, oversize 1 HP, 3450 RPM totally enclosed motor.

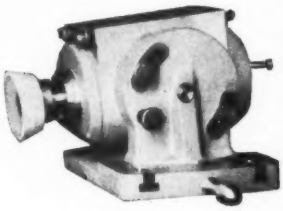
POPE

on INTERNAL GRINDERS

specify the NEW series of **POPE** belt driven, cartridge type Precision Internal Grinder Spindles, up to 54,000 RPM, with chrome plated, stationary cap in place of the old, revolving type.

It's the SPINDLE That Does The Work

on TOOL and CUTTER GRINDERS

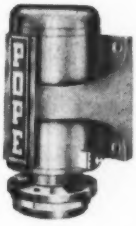


specify **POPE P-6651-A** 3600-RPM Motorized Tool and Cutter Grinder Head with angular adjustment in a vertical plane.

POPE

on GRINDING, MILLING, BORING

specify **POPE P-2500** Heavy Duty Direct Motorized Spindle for grinding, milling, boring —¾ to 100 HP.



It's the SPINDLE That Does The Work

on WHEEL HEADS

specify **POPE P-12004** Heavy Duty Vee-Belt Driven Machine Wheel Head for up to 4000 RPM—½ to 50 HP.

POPE

on 6" x 18" SURFACE GRINDERS

specify **POPE P-6351** High Speed Vertical Spindle Attachment for 6" x 18" Surface Grinders — 15,000 RPM.

It's the SPINDLE That Does The Work

★ *For complete specifications, prices and delivery estimates on these and the many other Precision Spindles on which the quantity and quality of a machine's production so largely depends, get in touch with*

No. 90

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION
ESTABLISHED 1920
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BUILDERS OF PRECISION SPINDLES

For *NEW* Speed and Accuracy in *PRODUCTION GAGING* . .

the PAR-AC

***A Basic Aid to Quality Control on Long- or Short-Run Work**

THE PAR-AC Electronic Production Gage brings *new speed and accuracy* to repetitive gaging of one or more dimensions. Also, it gives the *dependable, numerical data* you need for statistical quality control — right at the machine — as quickly as parts can be placed beneath the gage head. Here are the reasons why:

FAST. *Has instantaneous meter response,* without overshoot; easy-to-read scales; quick set-up.

GIVES CONSISTENT REPEAT READINGS, because (1) frictionless gage head movement means *no sticking, backlash or lost motion;* and (2) amplifier is *free from drift* on both intermittent and steady use.

SENSITIVE. Depending on the model, reads .00001" and .0001" — or .00005" and .0005" — per scale division, either side of center zero, on continuous linear scales. *Both scales of any model always give same reading* for any displacement within their range, and are *used interchangeably* at will.

VERSATILE. Used for long-run, short-run and tool room gaging. If desired, gage head and amplifier can be used with special fixtures.

GIVES PERMANENT RECORD if desired. A pen recorder is readily connected to the PAR-AC for making a permanent chart record of the measurements.

THOROUGHLY PROVEN in automotive, electric motor, precision bearing and other plants.

FREE PAR-AC BULLETIN gives full details; shows typical applications. Write for a copy.

AND ask about the INDI-AC Electronic Indicator for all-around use; MICRO-AC Electronic Microcomparator (reads in millionths of an inch).

Designed, developed and manufactured by

CLEVELAND INSTRUMENT CO.
Formerly Graham-Mintel Instrument Co.
739 CARNEGIE AVE. CLEVELAND 15, OHIO

Top News for Top Management

blamed for the depression of the 30's, and the recession of '38. For unemployment, for poverty, for building plants at government expense. For conspiracy of all kinds. For overproduction and underproduction, for technological achievements which threw men out of work and for lack of technological advancement. For monopoly and for failure to work together, for sinister planning and lack of foresight, and on and on.

"Our employees have been told that we are their enemies and we were for a long time even denied the right to discuss many mutual relationships with our own employees.

"Our advice has been seldom sought and when given has more often been ridiculed than followed.

"Truly we have been the hunted animal and have put on our protective coloring."

Mr. Carpenter suggested that there has been a lack of understanding of who are the people interested in or engaged in business. "The recent administration," he said, "appeared to single out a relatively small group and make it the target of numerous attacks upon business. Perhaps they had in mind the persons in the higher managerial positions of our larger companies along with the owners of the largest blocks of stock in those companies.

"But the fact is, of course, that these few do not represent all business; in fact they are only an insignificant part of all business. It is difficult to think of an American citizen who is not vitally interested in business, and whose standard of living is not so closely associated with business that he benefits with improved business, and conversely, he is injured as business is injured."

Also, he said, there has been insufficient understanding of the fact that the standard of living depends more on the standard of production than on any other factor. He said he felt "all these fundamental relationships will be better understood and more intelligently fostered by the coming

SPECIAL

PROFILE ROUTERS

BARTH BUILDS 'EM!
AIRCRAFT PLANTS USE 'EM!

. . They are used to speed-up and simplify the production of inexpensive dies . . note that the router can be precision tilted for angle operation. If it's a special machine, die or tool you need to speed your production, remember Barth's new, modern plant is geared to handle any and all jobs from the simplest tool or die to the most complicated, multi-stage special machine employing pneumatic, hydraulic or electronic operation and control.

BARTH STAMPING & MACHINE WORKS Inc.
12650 Brookpark Road, Cleveland 29, Ohio

DESIGNERS AND BUILDERS OF DIES. TOOLS AND SPECIAL MACHINERY

BE *Sure* YOUR
NEW ENGINE LATHE
CAN *Take* IT!

The engine lathe you buy today could be the one you will call upon for 'round-the-clock production. Make sure, before you buy, that the lathe of your choice can take such punishment.

ASK ONE QUESTION!
What is the headstock gear arrangement?
MAKE SURE OF THREE POINTS

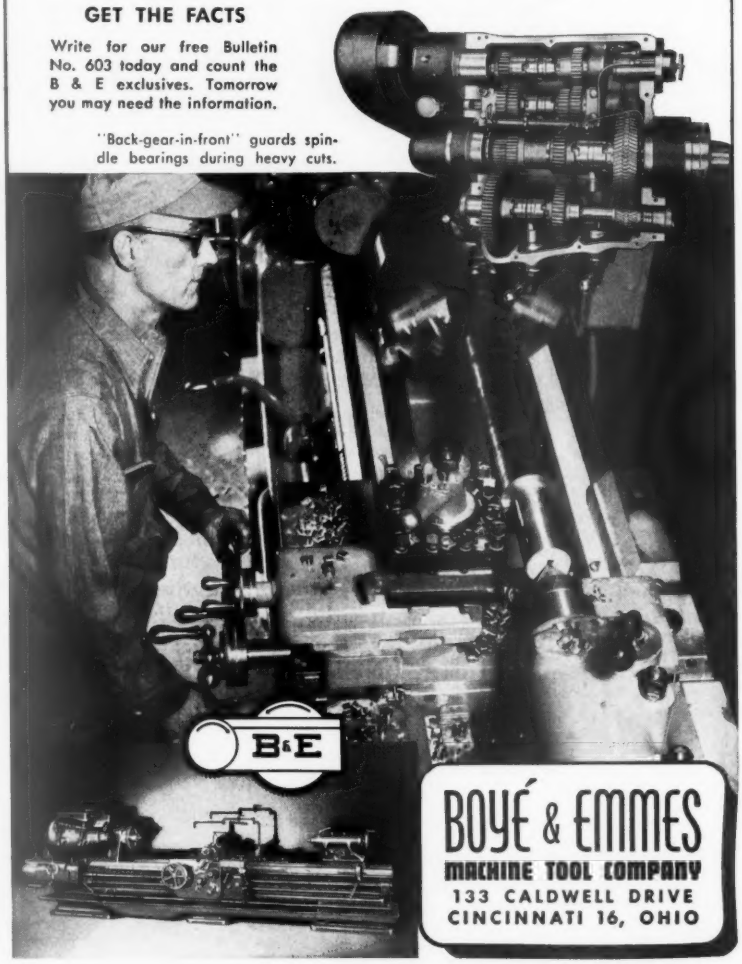
(1) That all gears are arranged in a horizontal plane; easy of access.
(2) That gears are in constant mesh, with speed changes effected by means of sliding jaw clutches; eliminating gear wear due to shifting action.
(3) That the "back gear" is in front of the spindle, exerting its powerful downward thrust to offset the lifting action of the tool when heavy cuts are made.

On these three points long life for engine lathes depends. At these three points Boye & Emmes Long Life, Heavy Duty Engine Lathes excel.

GET THE FACTS

Write for our free Bulletin No. 603 today and count the B & E exclusives. Tomorrow you may need the information.

"Back-gear-in-front" guards spindle bearings during heavy cuts.



BOYÉ & EMMES
MACHINE TOOL COMPANY
133 CALDWELL DRIVE
CINCINNATI 16, OHIO

Top News for Top Management

administration, and will importantly improve the climate within which we will be priviledged to operate."

The keynote of the transition, Mr. Carpenter said, is General Eisenhower, whom he described as "a man of high principle, clear vision, and an amazing leader," and one who "believes that the welfare of our country is not the responsibility of just a few of our citizens, but is the responsibility of all."

Evanson Forecast:

One of the new problems facing management today is management itself, and is posed by the many years of wartime economy through which we have passed. During those years many new and junior members of the management team have attained positions of leadership and responsibility in industry.

The consequent problem is pointed up with quite some emphasis in his introduction to a 1953 forecast offered by Clifford E. Evanson, president, Technical and Business Engineers, Inc., of Chicago. Mr. Evanson reminds us that:

"Many in the top management family have never functioned under competitive market conditions, for which reason executives will have to be retrained. They will have to change their attitudes and alter their thinking on many business problems. The emphasis of government controls will shift to private controls, including market, production, quality and costs. Directive boards will put as much emphasis upon an audit of the managing executives as they will on financial and physical audits. Potential executive caliber personnel will be screened early and given formal preparation for their future responsibilities. Top Management is developing yardsticks for measuring executive productivity."

A GOLD MINE OF

Job-Proved, Cost-Cutting, Production Helps

Methods and Production Case Records on a wide range of actual operations

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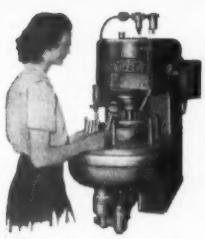

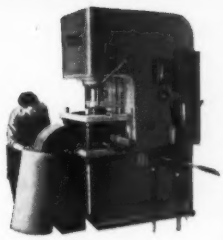

See how *others* cut costs with

MULTIPRESS®

Facts and figures from hundreds of actual users tell *how* and *why* the smooth oil-hydraulic power and control of Multipress cuts production costs. Our Data Log reports on these applications may offer better answers to some of your own production needs.

Multipress offers complete adjustability of ram speed, pressure and stroke length.

Pressures build up instantly as the ram contacts the work . . . there's no hammer-blow impact on work or tooling.

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Many other types of valving, ram controls, auxiliary feeds, operating accessories and tooling attachments can be interlocked with the Multipress ram action. Let us send you full details on Multipress.

Write Today for Data Logs on types of operations your production requires.

DENISON Hydr OIL ics TRADE MARK

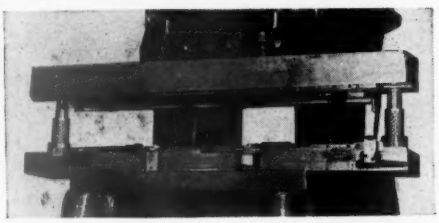
The DENISON Engineering Company **1197 Dublin Road, Columbus 16, Ohio**

LEMPCO Die Sets Cost Less by reducing cost per piece

Perfect alignment of pins and bushings mounted with pre-loaded ball bearings enables the die to close more accurately, produce less scrap, yield more pieces per grind. The dies last longer. Also eliminates binding on extended or overhung dies.

A dab of cup grease at regrinding time is all the lubrication that is necessary. You can forget about maintenance when your die is in the press. Frozen bushings, scored pins and chipped dies are rare occurrences. Frequently an entire production run can be completed before regrinding is necessary.

Yet with all of these advantages, Lempco Die Sets cost very little more than other die sets. Delivery on most sizes within 5 days, others in two to three weeks. Write for catalog and prices.



Save 15 minutes out of every 60 in die assembly . . . no pry bars, lead hammers or die pullers necessary.

Perfect alignment on every try.

LEMPCO PRODUCTS, INC.
Industrial Division
Bedford, Ohio

LEMPCO DIE SETS are priced competitively

LEMPCO for 35 years . . . a leading builder of machine tools

Top News for Top Management

from the Chamber of Commerce of the United States

Times are booming. People are earning more than ever before in America's history. Almost everybody who can work has a job.

And it looks like a real business-boom, not just a defense-spending boom. For defense spending is below expectations.

The big question, of course, is how long will prosperity last. Are we about to plunge into another depression? A good many economists, including those in the Chamber of Commerce of the United States, look for prosperity to last through next year, unless there are major developments in foreign affairs, particularly Korea. Even then, no major recession looms.

On the other hand, there are some who agrue the boom can't last. That we're in for another "bust."

U. S. Chamber of Commerce economists take a different view. They believe that depressions are not inevitable, that both business and government have learned a lot since the thirties about licking the boom and bust fiascos. They have learned counter-measures. They are less likely to be caught napping if business begins to drop.

Government, naturally, is a major force in resisting depressions. By purchasing its own bonds from the public it can pour money into circulation. Through loans, or the guarantee of loans, government can make it easier for business to borrow money for working capital or investment in new plants and equipment. Or, by means of its controls over banks, government can reduce reserve requirements so that banks can loan with more freedom. Experience during the last depression has shown how these controls can be use more effectively.

New factors are the Securities and Exchange Commission and the Federal Deposit Insurance Corporation. With its tight con-

trols over market speculation, SEC can prevent one of the evils leading to the last depression. And citizens' bank savings now are insured up to $10,000 by FDIC.

Also new since the early thirties are the government old-age and unemployment insurance systems, providing a backlog of security against loss of income due to age or unemployment. And of course, many business and industrial firms have begun pension plans since the thirties, providing additional insurance against hard times.

Finally, there is a brighter outlook for trade, another important item in the prosperity picture. they may be."

For its part, business is better prepared for a depression than it was back in '29. It has learned much about management. And it has a far bigger, more versatile research plant for the creation of new products when the sale of products already on the market begins to drop. Products which meet basic needs resist depression. This is not speculation. Refrigerator, electric washing machine and radio sales, for example, held up well during the bleakest days of the thirties.

Today, many, many new products are on the drawing boards or ready for market. A refrigerator which makes up to 300 ice cubes per day without trays is on its way to the customers. A big chocolate firm has just introduced a versatile cookie mix which can be used for dozens of different cookies. A St. Paul firm is developing magnetic tape which will record television programs the way radio programs now are recorded. Taped television would be clearer than filmed and much cheaper since tape can be erased and re-used.

These new products mean new jobs, and new jobs mean continued prosperity.

Further, business has a new sense of responsibility. It is less likely to begin major lay-offs and wage reductions in the face of a little adversity. Less likely to panic. It is far more likely to look around for new ways to maintain production than to sit back and do nothing.

This isn't speculation either. During recent years several individual industries have gone through a kind of recession and are starting to pull out. Textiles is one. Paper is another. The jewel-

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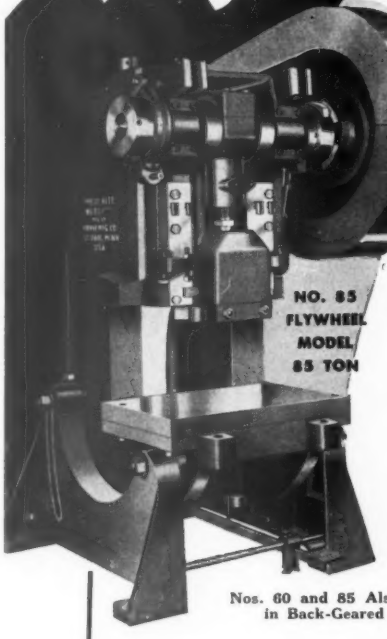

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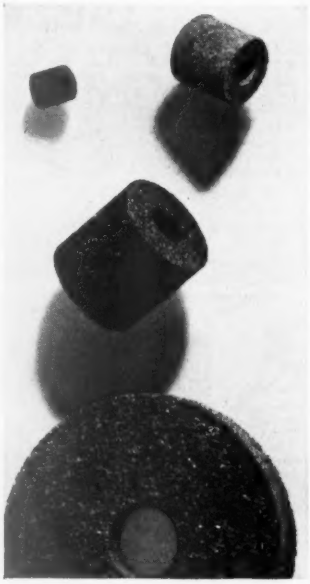

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Top News for Top Management

ry business was in trouble in 1946 and 1947 and made the necessary adjustments each time.

Another example of forward-looking management is the auto industry's campaign to promote good roads. You might think that automakers would prefer bad roads which ruin autos so that new cars could be sold more readily. But the automobile and allied industries believe that the money motorists would save because of better driving conditions would go into new fields, new industries. Thus new markets are created.

Finally, there are new developments in foreign trade. Here too, business has looked ahead. Since the last war, Europe has been a poor customer. So American business is investing its dollars in Canada and Latin America where resources still are unlimited.

These are the reasons why the Chamber of Commerce of the United States looks for lasting prosperity. We have the government and private pension plans, the unemployment insurance to cushion us against recession. We have the vast resources developed by science. The new, more foresighted, more confident management which has developed over the years. And we have been developing new and richer foreign markets.

from the AMA

Last month's three day Manufacturing Conference of the American Management Association was an outstanding event on all counts: the managerial experience and know-how of the discussion leaders and partcipants; the range of the subjects covered; and the practical applicability of the expressed ideas, opinions and recommendations, to the problems facing manufacturing management in the critical months ahead.

The following excerpts from the many panel discussions are indicative of the thinking of industry leaders.

Microbore...

PRODUCTION EQUIPMENT

Engineered and manufactured by

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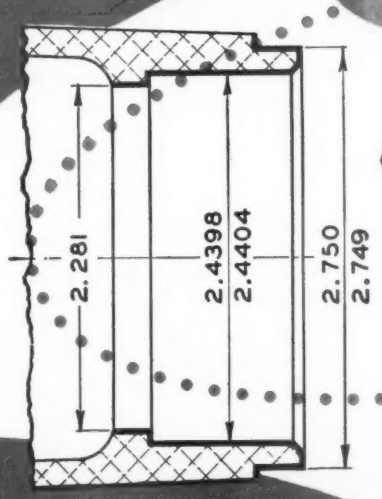

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Illustration shows Microbore cluster tools for machining seven surfaces on a main bearing housing at one pass. Microbore system of tool adjustment permits fast set up and precise limits are maintained on production runs.

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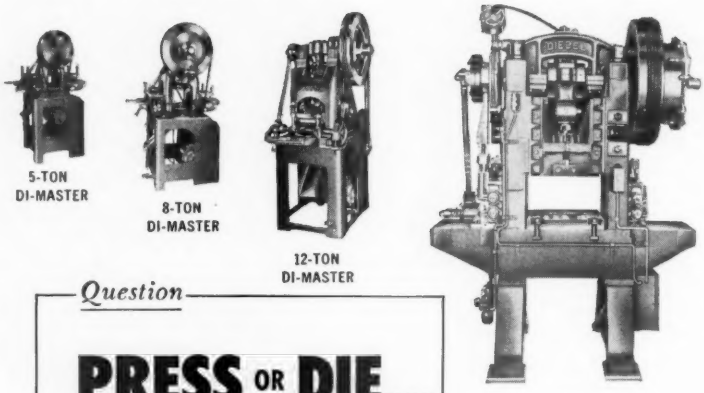

Question

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For automatic operation, press and die are of equal importance and should be regarded as an integral unit.

When considering presses, as much thought should be given to their precision accuracy as to that of the die.

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Top News for Top Management

Rising labor costs, the need for maintaining uniform quality of products, and technical necessities are bringing the automatic factory closer every day, members of the panel that discussed automation agreed.

Ford Motor Company turned to automation because of the desire to control "the cost you can't seem to stop—labor cost," Ray H. Sullivan, Vice President, Engine and Pressed Steel Group, reported. Ford also, he said, wanted to get some of the drudgery out of factory work.

Automatic production processes such as those used at the Ford plant in the Cleveland area can save 25 per cent to 30 per cent in direct labor, Mr. Sullivan reported. Because of the increased need for indirect workers, however, this is not a net labor saving, he emphasized.

With automation, as with other technical improvements, labor saving need not mean excessive technological employment, the panel members emphasized. More and cheaper products may bring rising demand, a higher standard of living, and new job opportunities for the displaced, as in the past.

Automation will bring many changes in industrial methods and personnel, the panel predicted. More creative product design will be needed, according to John E. Arnold, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Designers will have to develop new products to fit the new production processes, and those designers will have to be men capable of forgetting traditional concepts.

Production changes also will be extensive, according to Professor Arnold. Industry may be tempted simply to add the new automatic devices to existing equipment when it might be better, he said to re-examine the whole productive process and start all over again.

Personnel requirements will be different with automation. The

supervisor's job will change; he will need more knowledge of the overall production process and more skill in dealing with his subordinates. Automation will not necessarily mean fewer supervisors; Ford uses 1 supervisor for every 18 workers at its automatic plant compared with 1 for 31 in more traditional factory, Mr. Sullivan reported.

Training of skilled workers will be a problem, the panel members agreed. Companies will need to work with universities and local trade schools to get the men they will need, Professor Arnold said.

There won't be much of a recession, if any, next year; in fact, if we keep working hard, we may pass by any recession that is coming without even noticing it. This was forecast by H. Thomas Hallowell, Jr., President, Standard Pressed Steel Company.

Mr. Hallowell reported "quite a change in confidence" in this country since the election. "Our business," he said, "is very sensitive to management morale", and that morale is now high. He also reported more confidence on the part of the workers because of better understanding of how the economic system works.

Mr. Hallowell predicted inflation "as long as you can see in the future." The solution, he said, is better machines and better organization. Industry must buy more new machines and use more capital in relation to labor. Instead of postponing modernization, Mr. Hallowell advised companies to "get rid of the old stuff" and put new equipment in now. It will cost more later, he warned.

Increased productivity demands better organization as well as better machines, Mr. Hallowell pointed out. "That means," he said, "management doing its job".

The average management, Mr. Hallowell claimed, is far behind the times in relation to its workers' thinking, its modern machine tools, and its modern plants. It's up to management men, he said, to take positive, constructive action to promote the long-run growth and success of their companies.

The American public will want more in years to come, and it will get more, Mr. Hallowell promised. The standard of living has doubled in the last 50 years and can more than double by 2000 if management does its job in increasing productivity. "Remember, there is competition in management too", he concluded.

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January, 1953

Editorial: OUR OWN "RETOOLING PROGRAM" 41

Gages

"Location Limit Gages, Their Design and Use" by N. M. Olney, Federal Mfg. & Engineering Co. 43

Mr. Olney shows how to make and use hole location gages which can be as effective and simple to use as the cylindrical plug gage.

Dies

"Die Quench Saves Dollars" 46

A brand new technique has been developed by North American Aviation, called "die form quenching", for forming the wings of airplanes.

Cutting Tool Materials

"How to Select Cutting Tool Materials for Automatic Screw Machine Work" by Lester F. Spencer, Landers Frary & Clark 48

Mr. Spencer discusses the importance of selecting the right cutting tool material for machining materials having different machinability characteristics.

Dies

"Principles of Cutting Sheet and Strip Metal with Press Dies" 52

This is a chapter from the fourth edition of "Die Designing and Estimating". It treats on the principles of the various press-die cutting operations, including cut-off, blanking, piercing, trimming and shaving.

Plastic Models

"The Plastic Model as an Engineering Tool" by Arnold P. Saviano, Creative Industries of Detroit 60

Plastic models are filling a need which has existed in the design field for some time. It is much easier to analyze a problem when a model is held in the hands and can be twisted, turned and viewed in various positions.

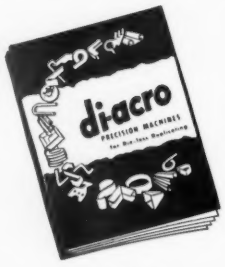
Cost Controls

"Operating Cost Controls Offer: Increased Productivity; Dollar Economies, Less Scrap and Waste" by M. K. Sheppard, M. K. Sheppard and Company 62

It is the opinion of the author that good operating cost control must begin at the foreman level and be developed carefully from this level to the top.

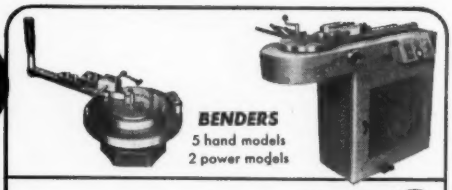
di-acro

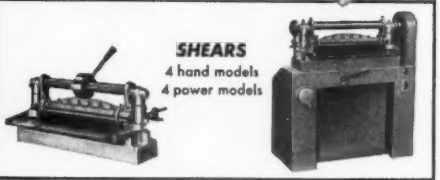
PRECISION MACHINES for Die-less Duplicating

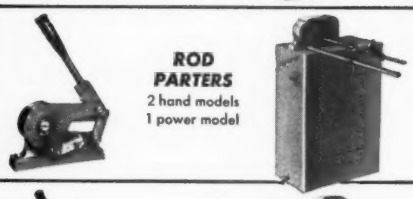


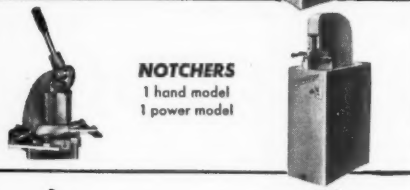
NEW CATALOG packed with ideas for making parts by "Die-less Duplicating"—the money-saving, time-saving technique created by Di-acro.

BENDING MANUAL gives exact methods for bending processes in a variety of materials. Over 90 diagrams and charts with tooling suggestions. *Sent on Request*

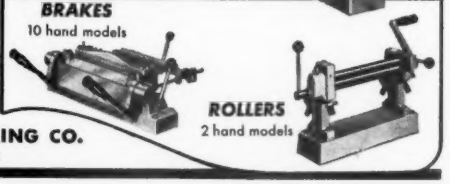

BENDERS
5 hand models
2 power models


SHEARS
4 hand models
4 power models


ROD PARTERS
2 hand models
1 power model


NOTCHERS
1 hand model
1 power model

PUNCH PRESSES
2 hand models
2 power models


BRAKES
10 hand models

ROLLERS
2 hand models

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Hardness Testing

"Hardness Testing Equipment and Methods" Part I by John E. Hyler 64

Hardness is a quality definitely known to exist, but there is no precise definition of the term. The measurement of hardness is comparative and Mr. Hyler describes the several types of equipment in popular use.

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International Limits Standardization 74

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Look—a pictorial selection of today's newest literature. Reach up on the rack and take your pick.

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Capsule descriptions of current literature. Bulletins, brochures, catalogs and circulars—you name it!

"SHOP AIDS" 127

Need help in any aspect of modern metalworking? See this section for materials and design aids, inspection and production techniques.

"PROGRESS ON PARADE" 139

Check this carefully. It can bring new efficiency to your operation. The newest in machines, tools, and accessories.

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A Harig precision shaving die built to shave teeth on the inside diameter of large ring used in a military vehicle's automatic transmission.

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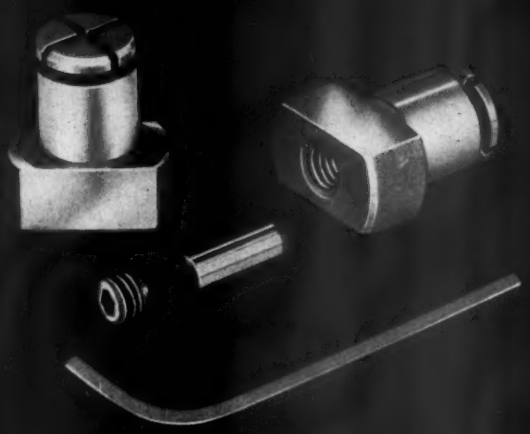

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SFK 625	.625	.6245	1"
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SFK 750	.625	.7495	1-1/8"
SFK 8125	.625	.812	1-1/8"
SFK 875	.625	.8745	1-1/8"
SFK 9375	.750	.937	1-3/8"
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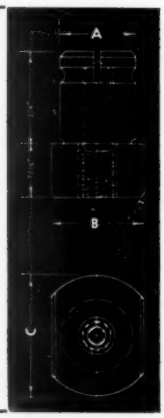

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editorial

OUR OWN "RETOOLING PROGRAM"

In the pursuit of our editorial objectives we like to think of our magazine as a means of communication and conveyance. It is the means whereby our authors communicate with our readers and convey to them the tooling and production know-how which they, the authors, have acquired in attaining the responsible positions they occupy in industry.

The vast majority of the editorial features which we present we specifically solicit from men whose respective accomplishments in the many subdivisions of the tooling and production picture are known to us and stamp them as authorities.

Our editorial concept and program stems from the simple fact that without tooling there could be no production and that without production there would be no need for tooling.

The composite activity by which our contributing technicians, all men of industry, have earned for themselves worldwide renown, and which has given our country unprecedented standards of living, is their superlative faculty for designing a product for mass manufacture. Added to this is their ability to create the ingeniously conceived and precision-made production tooling essential to the highest productivity.

Working intimately as we do with these leaders in the designing and building of tooling for production, in retooling for increased productivity and reduced costs, in quality control for higher acceptance and lessened waste, it is only natural that we should have embarked upon a "retooling program" of our own.

This we have done, and this is it — this new and larger format of TOOLING and PRODUCTION you now hold in your hands.

Printed pages are the tools of our trade and are what we use to build our end-product — a package of authentic, highly-skilled, proved-in-practice, metalworking know-how and show-how.

As such, then, our printed pages in treating the vast activities of tooling and production are just as subject to the benefits to be derived from "retooling" as are any screw machine product, stamping press activity or assembly line.

Whereas in metalworking, retooling is designed to increase productivity, so does our new large page size increase the productivity or effectiveness of its message-carrying job. Larger illustrations, larger and bolder type styles, more generous borders and refreshing use of white space, all combine to enable the page to do a better job.

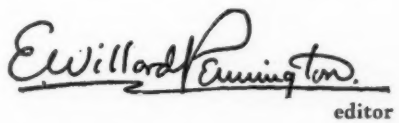
As in metalworking, where retooling is done to accomplish cost reductions, so do our larger "retooled" pages reduce your "cost" in reading time.

Again, as in metalworking where retooling makes work easier, so do our "retooled" pages make easier for you the job of receiving and retaining messages they convey.

By the same token, our larger and more generous page areas make easier and more pleasureable for us the job of "packaging" and displaying the fine material that our authors painstakingly originate.

Every benefit that accrues to our editorial pages in these many respects is enjoyed equally throughout our advertising pages. The larger areas, be they two-page spreads or one-eighth pages, enable our advertisers to do greater justice to their products. Larger illustrations, less crowded technical copy and data, and more effective use of color and layout all combine to make it easier for the reader to appreciate what is being offered.

With that our case rests in your hands. After all, our own "retooling program" is nothing more or less than practicing what we preach. We hope we have won your continuing approval and support. We will be more than pleased if you can take a bit of "time out" from a busy day to let us know how you like the "retooled" TOOLING and PRODUCTION. We would even much rather have criticism than "no comment."



editor

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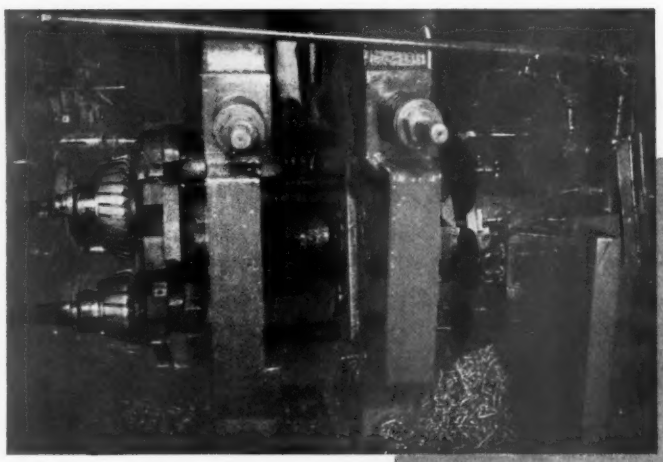
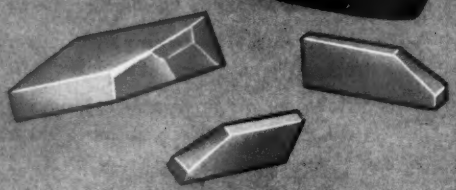


HERE'S AN OUTSTANDING EXAMPLE IN THE AUTOMOTIVE INDUSTRY



ACTUAL JOB	AUTOMOTIVE PLANT
Machine	Davis Thompson Milling Machine
Part	Rear axle shaft
Operation	Rough and finish mill spline end
Material	S.A.E. 1035—Brinell Hardness 179-229
Tools	Wessen 6" and 8" dia. Milling Cutters—fine pitch—braze type
Speed	8"—387 S.F.M. 6"—290 S.F.M.
Feed	14" per min. Feed per tooth 8" dia. (28 teeth) .0021 Feed per tooth 6" dia. (20 teeth) .0030
Production	150 pcs. per hour, 1500-1700 pcs. per grind
Grade of Carbide	Wessenmetal WM

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WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

WESSONMETAL Cemented Carbide

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

Here is a gage design that offers a fast, dependable, and inexpensive means of inspection for hole location. For repetitive work its simplicity insures its effectivess.

by N. M. Olney
Tool Engineer
FEDERAL MFG. & ENGINEERING CORP.
Brooklyn, N. Y.

LOCATION LIMIT GAGES

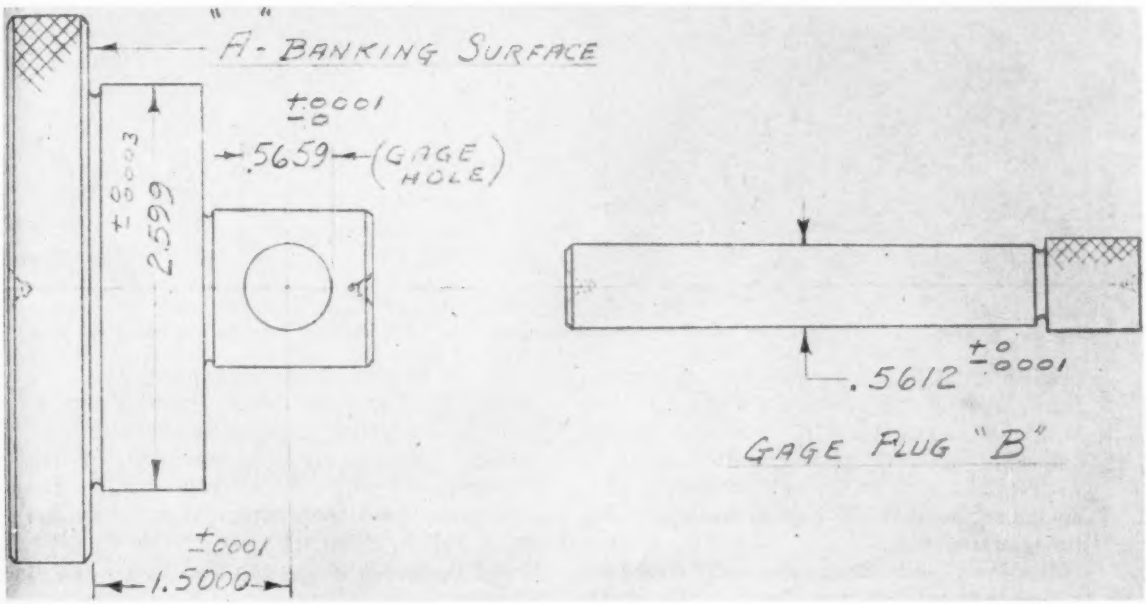


Fig. 1. The gage is used by placing and holding the piece-part, Figure 2, firmly against the banking surface "A" and inserting the gage plug "B" through both part and gage holes. If the hole is located within the tolerance zone, the plug will enter both holes freely or with a light push fit. It is essential that the work hole diameter be within its specified limits.

Their Design and Use

In repetitive type manufacture it is seldom that one does not encounter a pressed metal or machined part specifying that a hole be located from some given point or surface.

To determine hole location in production parts by conventional means can be a time consuming procedure involving the use of a suitable gage pin or plug, surface plate, gage blocks, height gage and indicator. Although this basic method of inspection provides accurate information, it is not suited to mass production operations for reasons which are quite obvious.

The answer to rapid hole location inspection may frequently be found in the use of "Location Gages". Properly designed and used, this type of inspection tool is as effective and simple to use as the conventional cylindrical plug gage.

Used in Ordnance and other mass production industries it offers a fast and dependable means of determining whether the hole location is within the working tolerance specified and in addition is no more expensive to build than any other comparable grade "A" tool.

Location Limit Gages are suitable where the part hole location tolerance is greater than the hole diameter tolerance. The location tolerance should preferably be more than .002.

The gage shown in Figure 1 represents one of an infinite number of forms embodying this principle of design. Inspection is made by

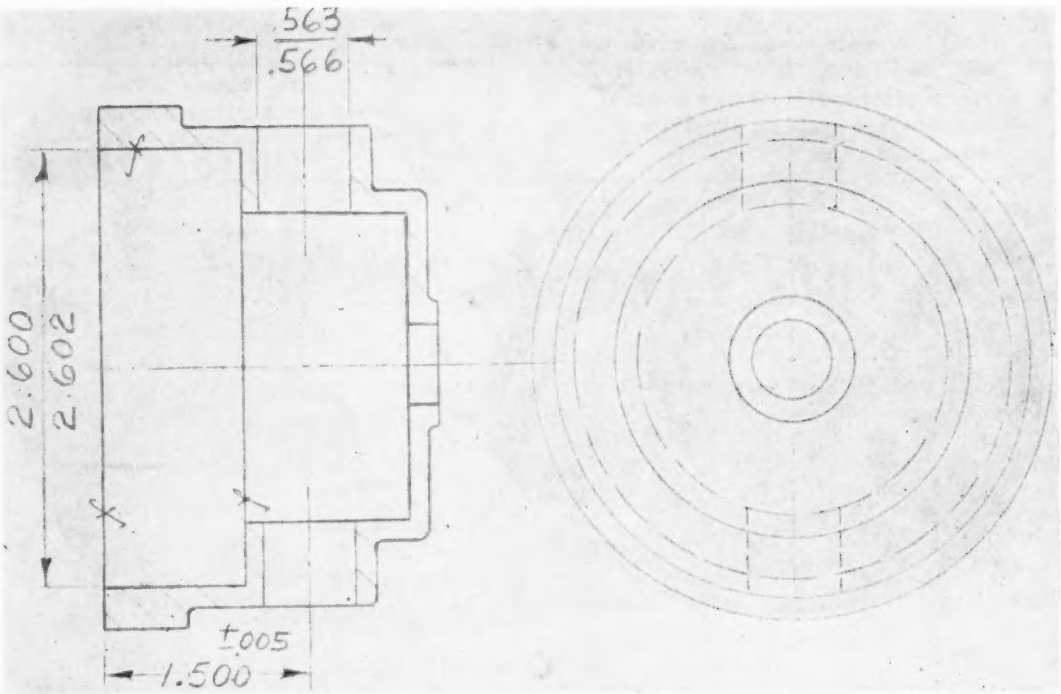


Fig. 2. Workpiece for which the hole location gage was designed. The 2.600 diameter must fit freely over the gage.

placing and holding the piecepart, Figure 2, firmly against the banking surface "A" and inserting the gage plug "B" through both part and gage holes. If the plug enters freely or with a light push fit through both holes, it is an indication that the hole is located within the tolerance zone.

However, the location gage is effective providing the part hole diameter is within specified limits. Since the size of the gage hole and diameter of the gage plug are both influenced by the dimensions and tolerances of piecepart hole diameter and location, it is essential that the part hole size is checked with suitable plug gages prior to using the location gage.

Determination of Basic Gage Dimensions

The 2.600 diameter of the part must fit freely over the gage, consequently the gage in this case is made .001 smaller than the minimum diameter of the part so as not to influence inspection. The gage hole must be located at a distance equal to the nomial part hole location or 1.5000. Its diameter must be made equal to the maximum tolerance limit of the part hole or .5660.

Since the location gage plug diameter is a function of both part and gage holes, its diameter must be based upon the condition which occurs when the part hole location is at the minimum or maximum tolerance limit with respect to the gage hole, as indicated in Figure 3.

It will be readily seen that in order that the plug "B" may enter both gage and part, it must be smaller by the amount of interference which occurs under this condition. If the Diameter of plug "B" is made equal to the condition based upon minimum part hole and gage hole interference as at "X", a situation could develop whereby the part hole when at maximum diameter could be beyond the permissable location tolerance by the amount "Y" and still be accepted by the gage as a good part.

The amount "Y" represents one half the difference between minimum and maximum diameters of the part hole. To offset this possibility the plug is made equal to diameter "X" plus "Y" which is the corrected basic gage plug diameter. Altho this prevents the condition described, it reduces the allowable location limit from minimum or maximum by the amount "Y" when the part hole diameter is running at the low limit. When the part hole is at maximum diameter and its location is at the high or low tolerance limit, practically the full working tolerance is maintained.

Gage Tolerances

The determination of suitable tolerances and their application in the right direction is just as important, if not more so, than determining basic dimensions. Tolerances allocated incorrectly to gage plug diameter, gage hole location or diameter may cause good

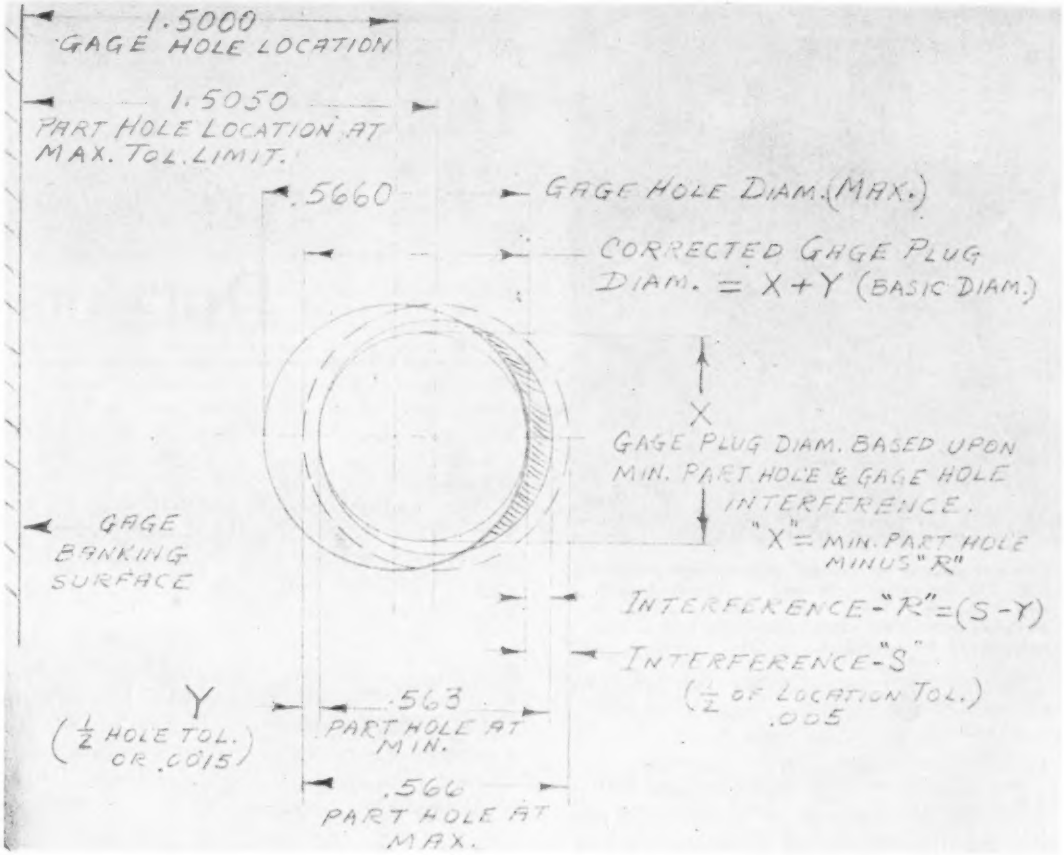

1.5000
GAGE HOLE LOCATION
1.5050
PART HOLE LOCATION AT MAX. TOL. LIMIT.
.5660
GAGE HOLE DIAM. (MAX.)
CORRECTED GAGE PLUG DIAM. = X+Y (BASIC DIAM.)
X
GAGE PLUG DIAM. BASED UPON MIN. PART HOLE & GAGE HOLE INTERFERENCE.
"X" = MIN. PART HOLE MINUS "R"
GAGE BANKING SURFACE
INTERFERENCE-"R"=(S-Y)
INTERFERENCE-"S" (½ OF LOCATION TOL.) .005
Y (½ HOLE TOL. OR .0015)
.563 PART HOLE AT MIN.
.566 PART HOLE AT MAX.

Fig. 3. This layout shows the calculations and allowances necessary to insure that practically the full working tolerance of the part under inspection is maintained.

parts to be rejected more readily by further reducing the working tolerance or can cause bad parts to be accepted.

Gage Hole Location Tolerance

The gage hole must be located equal to the nominal piecepart hole location. The hole should be jig bored, the tolerance applied bilaterally and maintained preferably at not above plus or minus .001. An increase in tolerance adversely effects working tolerance.

Gage Hole Diameter Tolerance

Diameter should be made equal to the maximum diameter of the part hole and tolerance allocated minus.

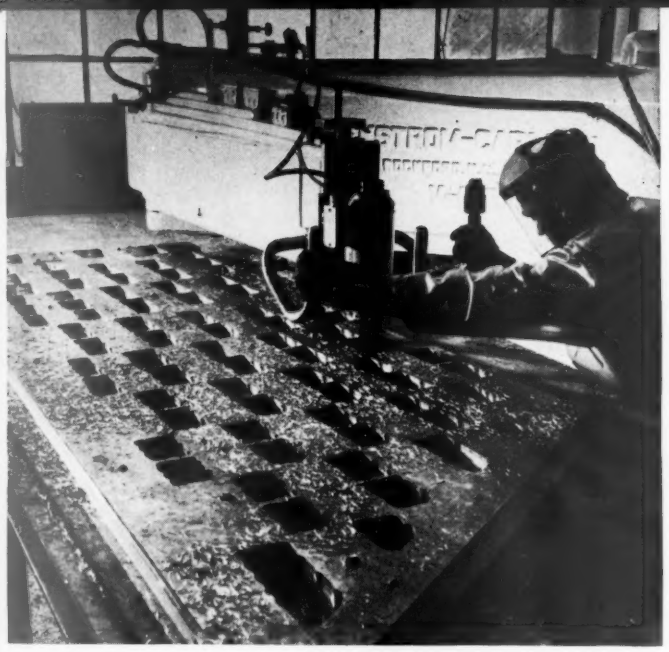
Gage Plug Diameter and Tolerance

Size is determined by adding to the basic gage plug diameter one half of the gage hole location tolerance. The sum is the required minimum diameter. Tolerance is applied plus by adding the same amount to obtain the maximum diameter. The reason for allocating the tolerance plus is to prevent the possibility of accepting work beyond the working tolerance zone.

Tool Life Increased by High-Velocity Blasting

"Pressure Blast" high-velocity wet-blasting has been used successfully for the lengthening of cutting tool life. In some cases more effective than hard chrome and much less expensive, taps, reamers, broaches, twist drills, gear holes, milling cutters, and cut-off saws have lasted up to 8½ times as long following pressure blasting with a fine, 5000-grit size abrasive.

Similar in effect to hand honing, pressure blasting removes feather edges and blends directional sharpening lines. Microscopic etching of the tool surface also occurs which creates thousands of tiny oil wells for better lubrication retention. The blending of the directional grinding lines insures smooth, even chip-flow and eliminates the possibility of the heat factor to "weld" chips into deep deep relief. The slight peening effect of the pressure blast substantially reduces fatigue failure possibility.



This grid replaces an assembly that formerly required over 200 individually stamped or machined parts and thousands of rivets. The waffle-like pattern is machined out by the router before the grid is heat treated and die quenched.

DIE QUENCH SAVES DOLLARS

THE WINGS OF AN F-86 SABRE have 35 doors. Through these doors, mechanics and inspectors probe and squint at the machinery which makes a wing do its many chores. Airplane designers are being slowly forced out of the wing into the fuselage to seek space for their equipment. But the industry is still a long way from punching wings out with huge presses like doughnuts in a bakery.

There have been drastic changes in the manufacture of wings, however. No longer do assemblers produce a wing from hundreds of components and thousands of rivets. The job has been reduced to a point where the joining of a relatively few parts forms the high speed wing of today's airplane.

In the Air Force F-86 Sabre and the new Navy FJ-2 Fury, for example, parts have been saved in wholesale quantities by relying on heavy, waffle-like members called "grids". And there is only one way to form these grids on a production basis. That is by a brand new technique, developed by North American Aviation, called "form die quenching". Through this process, designers have saved 225 parts in the wing of an F-86H, and a total of 214 parts in the Navy's FJ-2. This does not include the saving of thousands of rivets.

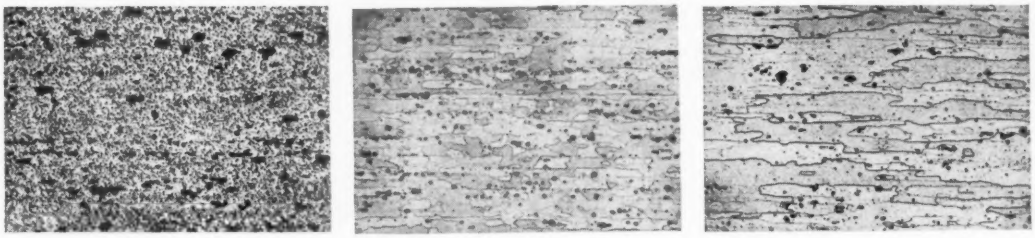
The saving in man-hours is of course very great. Some parts which formerly required up to 24 man-hours of power hammer work can now be made in eight minutes utilizing the form die quench process. The saving goes beyond the production of the individual parts. This saving shows up in the simpler assembly job on the wing, and in the reduction in stock bins, which now hold a few parts instead of hundreds of different parts.

Form-die quenching was developed by the company's Machine Forming Department, with technical assistance from the Production Development Laboratory. The new process is a method of forming extremely accurate contours in high-strength aluminum alloys. This is accomplished by combining the heat-treating, forming, and quenching into one continuous process.

"The reason die-quenching had to be adpoted for the grids was that conventional forming processes do not overcome different degrees of springback in the grids caused by variable properties in the heat-treated metal", said Joseph Corral, General Foreman of the Machine Forming Department and originator of the technique.

According to Mr. Corral, "The problem is further complicated by changes in cross-section and warpage in the part itself, caused by the relief of surface stresses in the machining operation. While forming may be done with the metal in the soft temper, the subsequent heat-treatment and water quench required to develop the full structural strength of the material cause the part to undergo serious warpage due to residual strains when the grids are water quenched. Deviations from the required contour, warpage, and dimensional changes caused by water quenching the grids are virtually impossible to correct".

So important is the program of form die quenching that two huge new presses are now being produced by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio—one for the Columbus plant and one for Los Angeles production. These presses, costing $500,000



Photomicrographs showing the structure of 75 S-O aluminum. Left, as the metal comes from the mill. It has been allowed to cool slowly and constituents have precipitated out. Center, super-saturated solution resulting from heating and die quenching. Nearly all of the soluble content has dissolved. Rapid quenching prevented precipitation, but this is not a stable condition. Right, the metal after die quenching and artificial aging. Black dots along the grain boundries show that some of the soluble constituents have precipitated. The metal is at its best in this state and will change little within the life of the airplane.

apiece, are being purchased by the Air Force and Navy for use at North American and will permit application of the new technique to much larger workpieces.

"Fast and less expensive" is the way to express the die quench process. The first grid to be made for an airplane at North American by this technique was on the experimental XF-93. Previously one for another experimental airplane was made on a power brake, but this was not successful. Power brake operation is a tedious hand process requiring great skill on the part of the operator, who constantly checks his work as he forms the contour. This means that each part is slightly different because of the human element involved in its forming. The form die quench process allows a huge press, with one giant squeeze, to form the part to a perfect contour over the die. Parts are exactly alike. The big new presses, each capable of exerting a squeeze of 14 million pounds—the weight of two destroyers—will form the contour in four seconds.

The part formed by the new process is relatively stress free, which may mean a gift of several thousand pounds per square inch to the designer of the part.

Internal stresses are locked up in the rolled plate as it comes from the mill. When the plate is machined, these stresses are relieved and the plate is no longer flat. For example, under machining, a plate may "walk" or bend as much as 3/16" to the foot. A long plate may have a bow in it, or be "out of flat" as much as 3" after machining. Some methods of forming parts put the stresses back in the part, and these must be subtracted by the designer when figuring how much load the part can take in the airplane.

"It's like this", says Charles Cole, metallurgist who assisted in working out the heat treat formulas for the die quench process. "If you have a rope which will hold 1,000 pounds, the rope will hold not 1,000 pounds but 900 pounds. The weight of the hook must be taken into consideration when figuring the load it will carry".

A relatively stress-free part actually allows the designer to design a part smaller. And both weight and space in a wing are like meat and potatoes to an airplane designer.

The process developed by North American allows the purchase of less expensive metal plate that has been only partially heat treated. In the machine shop, after skin-milling, pilot holes are drilled so that the big sheets can be held solidly to the routing tables in the Material Preparation Department. There the

. . . Continued on page 56

The hot grid is quickly transferred by mechanical means from the heat-treat furnace to the press, where it is formed and quenched in one operation.

Tool-wise, production-wise, and cost-wise the best results in a given tooling program can be had only when there is adequate understanding of the practical metallurgy of both the work material and the cutting tool material. This is a form of "teamwork" that Mr. Spencer is particularly fitted to explain.

How to Select

CUTTING TOOL MATERIAL for AUTOMATIC SCREW MACHINE WORK

by **Lester F. Spencer**
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

Introduction

Regardless of whether automatic, semi-automatic or standard single operation equipment is employed in a machining program, one of the most important phases of tool design is that of selecting the cutting tool material. Thus, it is natural that there should be a large number of tool materials so that each class of work and type of machining operation may be handled with the greatest possible efficiency. The selection of any one specific tool composition within a class for a given application can only be made after a careful study of the known conditions of the operation and of all available information regarding the material to be machined.

Other factors that would influence the choice of tool material can be summarized as:

(a) the selection of the machine tool along with the methods provided for tool holding and support;

(b) the type operation to be performed, whether it be facing, turning, drilling, etc.;

(c) the nature of the operation such as roughing or finishing;

(d) the condition of the equipment;

(e) the proposed lubricant and method of directing it onto the work;

(f) the design of the part to be machined; and,

(g) the machining conditions such as quantity, accuracy, finish and other production requirements.

In addition, the material to be machined must be thoroughly investigated as to its physical form and properties, chemical composition, heat treated condition, machinability, and probable relative magnitude of chip pressures.

The shape and relative strength or fragility of the part will have an important bearing on tool material selection. If the piece is irregular, an intermittent cut would require a tough, shock resistant material for the cutting tool. If the part is thin-walled and springy, a hard wear-resistant tool, which will retain its cutting edge for long periods at low cutting pressures, is required.

Materials to be Machined

Both the carbon and alloy steels, with the exception of the high alloy types such as the stainless and the high manganese steels, have very much the same cutting characteristics. Both cut with a continuous chip, and form a built-up edge on the tool if machined at low speeds. As the speeds increase, a critical point is reached above which this built-up edge is swept away and the cutting is more efficient, tool life is greatly extended and the finish is improved. This critical speed is affected by the hardness of the steel, the chip thickness, and to a lesser degree, by the depth of cut.

Good cutting practices are usually 50 to 100 percent above this critical speed. Thus, the term, "machinability" is often employed; this property being associated with long life at high cutting speeds and ease in obtaining a smooth finished surface. Occasionally, it also connotes low power consumption or low pressures on the tool face.

The use of the so called free-machining steels, which contain well distributed non-abrasive inclusions such as is exemplified by sulphide inclusions, has resulted in improved tool life and surface finish. Probably each cavity containing a sulphide inclusion behaves as a minute notch, since the reinforcement due to this soft inclusion is practically nil.

Because of the localized high degree of stress which is just ahead of the cutting tool, the chip breaks readily and the material behaves, at least with respect to the cutting tool, as if it were brittle. Moreover, the sulphide inclusion may possibly be smeared out and tend to act as a highly efficient lubricant which reduces both the abrasion of the tool and aids in producing a smooth finish. In addition, cold drawing, an essential prerequisite for automatic screw machine work, has also the effect of decreasing the ductility of the steel in regard to chip breakage which will also aid machinability.

The general tendency toward the use of steels of higher strength and toughness for various types of mass production parts has increased this emphasis on machinability. Although many of the characteristics of these unsulphurized steels are desirable from the standpoint of good parts design and service, they are usually directly opposed to good machining properties when compared to the sulphurized grades of steels. Thus, materials that have high hardness or materials with high ductility, even though accompanied by great softness, are deterimental to good machinability. In the latter case, the low carbon compositions are relatively difficult to machine when annealed to the lowest values of hardness.

In many instances, surface finish is of primary importance. In fact, the useful life of the tool may be regarded as being over as soon as any roughness becomes apparent even though the tool could continue to function for a much longer period of time before actual breakdown would occur.

Where surface requirements are strict, it may be necessary to control the micro-structure of the steel very closely; this being accomplished by suitable heat treatments, properly selected and controlled on the basis of such factors as (a) the specific machining operation; (b) the type and size of the part to be machined; (c) the chemical composition of the material to be machined; and, (d) the type and availability of the heat treat equipment within a plant.

Although detailed information regarding the use of tool materials will be given, it is only necessary to state at this point that the high speed tool compositions are generally employed in the machining of both the free-machining types and the so called high strength steel compositions in multi-spindle and single spindle automatic equipment. Thus, the high speed tools which have that well known property of "red hardness" have been found usually satisfactory for drills, reamers, counterbores, taps and threading tools, broaches, form tools including circular, flat or dovetail, and similar tools.

High speed steels have given satisfactory forming tool service with speeds varying from 30 to 400 feet per minute; a prerequisite being that the tool be rigidly supported. On any form operation, the success in the use of a tool material depends considerably on such factors as tool design and material machined.

In the event of a drilling operation, high speed drills of sizes $\frac{1}{8}$ inches and under have been used with success; the feeds per revolution ranging from 0.001 to 0.002 inches. On larger drills, one inch in diameter and over, with feeds varying from 0.015 to 0.020 inches and speeds from 30 to 400 surface feet per minute, the use of high speed steel is recommended.

In some instances, especially in the use of very small diameter drills or taps, where breakage is more of a factor to consider than tool life, it may be advisable to use a less expensive material such as a carbon steel. However, the choice of tool materials in this instance would be an individual problem and due consideration of all factors would be necessary.

In the event that high speed tools are not satisfactory, either the cast alloy type of tool material or the cemented carbides may be employed. In the former instance, a typical cast alloy that has been employed as a tool material is the non-ferrous cobalt base composition having chromium, tungsten, carbon and boron. This type of tool material has considerable more red hardness than any of the high speed tool compositions and, in addition, no subsequent heat treatment is required. It has the advantage in maintaining a cutting edge beyond the limits of high speed steel, but it is considered more brittle.

This cast alloy tool material is used only for roughing cuts on reamers and counter-

bores at speeds slightly higher than those used with high speed tooling; cast blanks as inserts being provided. It can also be used in a form tool where the speeds can be increased from 25 to 50 percent over that experienced for high speed tools; here again rigidity of tool setup being essential. It is limited in use for broaching, drilling and gear cutting and is not recommended for use in taps or threading tools.

The cemented carbides have both red hardness and resistance to abrasion values far above that obtained with any other type of tool material; however they are also the most brittle. A cemented carbide has the ability to out-perform most types of tool materials if the proper choice is made in view of the conditions of machining.

Ordinarily, the hard carbide is made in the form of tips or nibs which are used on steel shanks the design of which permits the carbide to function as the actual cutting edge of the tool. In smaller sizes, particularly for precision boring, solid carbide bits may be employed.

In the machining of high alloyed material such as the stainless steels, certain precautions must be observed, especially where the austenitic alloys are encountered. Thus, stainless can be divided into two groups, namely the hardenable (magnetic) and the austenitic (non-magnetic).

The hardenable stainless grades will machine similarly to the alloy steels of equal hardness, whereas the austenitic grades will work harden but are soft and gummy enough to build up on the cutting tool edge. The build-up tendency calls for the use of high speed tooling, whereas the work-hardened chip and machined surface require speeds in the lower range to prevent excessive tool wear.

The best condition is therefore a compromise, with a feed rate heavy enough to get under the work-hardened surface of the previous revolution and a speed high enough to avoid excessive build-up; recognizing meanwhile that tool life will be shorter than with equivalent jobs on other steels. Of interest is the information on tool material given in Table 1 for the machining of the stainless steels.

In the machining of the non-ferrous metals such as the aluminum alloys in automatic screw machines, relatively high speeds are used and the metal is removed at a rapid rate. Although the red-hardness characteristics of high speed steel is probably not utilized to the fullest extent, its high abrasion resistance makes it a first choice for the majority of tools. Standard applications of high speed steel tooling on such alloy types as 11S-T3, 17S-T4, R317S-T4 and 24S-T3 are box tool blades where exceptional finish and high rates of metal removal are experienced; large counterbores where high speeds, close tolerance and good finish are the requirements; form tools for roughing; and, such tooling as reamers, drills, facing tools, cut-off tools, drills recess tools, skive tools, shaving tools, and collapsible tap chasers, tap and threading dies.

In some instances, the carbon or low alloy tool steels may be used advantageously. For some fragile and small tools such as drills and taps, where tool breakage presents more a problem than tool wear, it may be advisable to use this less expensive material. Such tools can be drawn back in the shank, giving a tougher condition than is possible with the more brittle high speed tools.

Carbon steels are also employed as box tool V-rests, box tool roller rests, knurls, shaving tool rollers, supports, taps and collapsible tap chasers where breakage due to size may be experienced.

The use of cemented carbide tipped tools has opened new fields in machining the aluminum alloys. In some instances, by proper application over thirty times the life between grinds has been experienced as compared to high speed tooling. In many cases, the use of carbides is mandatory in order to obtain good tool life and a fine finish. This is especially true in machining the high silicon aluminum type alloys. Even though the extreme hardness of the carbide may permit the use of higher speeds, the speeds available on existing equipment may be such that full advantage cannot be taken of this outstanding property. Also, since the cemented carbides are relatively brittle when compared to the high speed steels, both judgement and knowledge of the operating conditions of a given operation must be employed to determine the suitability of this material.

The use of cemented carbide in the machining of aluminum and most other non-ferrous materials, will be determined by such factors as: (a) the speeds available on existing equipment; (b) the rigidity of the equipment; (c) the type of cut, whether continuous or intermittent; (d) the relationship of carbide speeds to other tools within the setup

Table 1 Approximate Tool Selection Chart

TOOLS AND OPERATING CONDITIONS	Type 1 High-Speed Steel	Type 2 High-Speed Cobalt	Type 3 High Cobalt	Type 4 Cast Alloys	Type 5 Carbides
TAPS, THREADING DIES, AND CHASERS — Moderate or slow speeds, increase speeds for fine pitch threads.	Excellent	———	———	———	———
CUT-OFF TOOLS. Circular or Blade Type — For average setups—medium or heavy feed, intermittent or heavy cutting at moderate speeds.	Excellent	Good	Good	Fair	———
CUT-OFF TOOLS. Circular, Blade or Insert Type — For special set-ups, employ medium or fine feeds at high speeds.	———	Good	Excellent	Excellent	Good
FORM TOOLS. Circular, Dovetail or Flat — For average set-ups, or finishing cuts, use heavy or light feeds at moderate speeds.	Excellent	Good	Good	Good	———
FORM TOOLS. Circular, Dovetail or Flat — For special set-ups—finishing cut at medium or fine feeds—at high speeds.	———	Good	Good	Excellent	Excellent
BOX TOOLS — Average setups—medium or heavy feeds and cuts at moderate speeds or intermittent cuts on Hexagonal Stock	Excellent	Excellent	Excellent	Good	———
BOX TOOLS — Special set-ups—medium or light feeds and cuts at high speeds.	———	Good	Good	Good	Excellent
LOW SPEED TURNING — For heavy feeds and cuts at moderate to slow speeds or intermittent cuts.	Excellent	Excellent	Good	Fair	———
HIGH SPEED TURNING. (Rigid Set-Up with Ample Tool Support.) — For medium and heavy cuts at moderate feeds and high speeds.	———	Good	Good	Excellent	Excellent
FINISH TURNING — Very light depths of cut at fine feeds—for obtaining a fine finish.	———	Fair	Good	Good	Excellent
REAMERS — For average set-ups—medium to fine feeds—moderate speeds.	Excellent	Excellent	Excellent	———	———
SPECIAL REAMERS — For special set-ups—medium to fine feeds at high speeds.	———	———	———	Good	Excellent
DRILLS — For average drilling conditions—medium to coarse feeds and moderate speeds.	Excellent	Good	———	———	———
SPECIAL DRILLS — For special applications — deep holes, etc. — use medium to fine feeds at moderate speeds.	Good	Excellent	———	———	Excellent (Rifle Drills)
SHAVE AND SKIVE TOOLS. (For Sizing.) — For finishing operations use fine feeds and cuts—moderate to high speeds.	———	———	Good	Good	Excellent
MILLING CUTTING — For average cutting conditions.	Excellent	———	———	———	———

The above table is offered as a guide and should be used with reservation, since type of equipment, special tool grinds, and individual efforts of machine operators and set-up men will vary.

which may not be carbide; and, (e) the rigidity of the tool support. As to the economics of the use of carbides, one must determine whether the selection of a carbide tool material can either reduce the down-time of the mcahine or whether it will speed up operations more than is possible with high speed tools. Carbide advantages must be balanced against possible higher tool costs, particularly if the tool is intricate.

When carbide tools are employed, a fine lapped finish is preferred; in many instances, the life of a carbide tool with a lapped finish may be several times that of a similar tool of coarser finish. Carbides are employed in many

. . . *Continued on page 91*

Principles of Cutting Sheet and Strip Metal with Press Dies

A Chapter from the 4th Edition* of "DIE DESIGNING AND ESTIMATING"

The various press-die cutting operations —including cut-off, blanking, piercing, trimming, and shaving—are accomplished by extending the work material over the cutting edge of the stationary die block and forcing another cutting edge, on the punch, down past the first. That portion of unsupported stock that offers interference to movement of the punch is forced on ahead of it, being **sheared** from the surrounding stock.

The **shearing** action severs the stock partially by cutting and partially by breaking the material. This is facilitated by the impact force of the driven tool. For this reason, cutting operations performed on punch presses are sometimes referred to as **impact cutting** as opposed to **chip-removing** methods of machining, where either the tool or the work—or both —revolves.

In a blanking die (Fig. 2-1), the die block is provided with an opening that conforms to the size and outline desired on the workpiece. The working end of the punch corresponds in cross-section to the die block opening but is slightly smaller in size. But, in a piercing die (Fig. 2-2), it is the punch that conforms to the size and outline of the hole desired in the workpiece, the die block opening being made slightly larger.

This dimensional difference provides a clearance between the punch and the die that is necessary for a smooth cutting action, to permit the punch to enter into the die block opening, and to prevent the descending punch from striking or rubbing against the sides of the die block opening.

*The popular Dannes & Bohmer textbook, "Die Designing and Estimating", is in the final stages of being thoroughly revised and enlarged. Copies of this book will be available for purchase at an early date. The chapter preprinted here has been contributed by Watson N. Nordquist, TOOLING and PRODUCTION's Technical Editor.

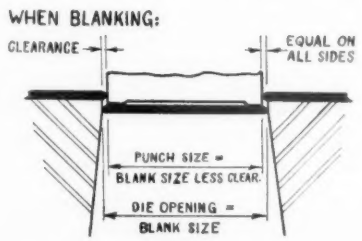


Fig. 2-1. Blanking die, showing necessary radial clearance taken from nominal punch dimensions.

Figure 2-3 illustrates what happens as the punch descends. At "A" the punch has just contacted the stock, the pressure having reached and exceeded the elastic limit of the material. The material "gives" in the direction where it lacks support and begins to stretch around cutting edges of the punch and the die block.

At "B" the descending punch has pushed the stock on ahead of it into the die opening. Broken lines shown running through the stock parallel to work surfaces represent planes of crystalline slippage under tensional stress. The sharper the tool edges, the greater will be the tensile stresses along the work surfaces and adjacent to the sharp corners. The smaller the clearance between the punch and die, the greater will be the compressive stress between these two cutting edges as they approach each other.

At "C" the ultimate shear strength of the stock has been exceeded. The stock begins to fracture in the direction of greatest stress and least resistance. With sharp tool edges, these stresses are sufficiently localized that fractures will start simultaneously from the cutting edge of the punch and that of the die block; and, with correct clearance between the punch and die block, these fractures will extend toward each other and meet.

At "D" the action has been completed, the punch is at the bottom of its stroke, and the blank has been completely severed from the surrounding stock.

Characteristics of the Sheared Edge

The influence of this impact-cutting action on the apperance of the pieces produced can be seen in Figure 2-4, which again shows several stages in development of the cut.

At "A" the descending punch has drawn the stock in a bend around its cutting edge and, at the same time, forced the stock down over the cutting edge of the

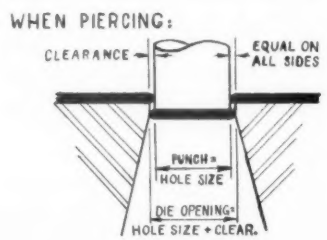


Fig. 2-2. Piercing die, showing clearance taken from nominal die block opening.

die. The radii adjacent to the tool edges represent permanent deformation of the work material.

At "B" the punch has penetrated the stock to the point of fracture. The cutting action and the burnishing effect of the work material being pulled down along the straight sides of the punch and the die block opening impart a bright polished finish along a proportionate section of the sheared edge.

At "C" the fracture is complete, the edge surfaces exposed by the "break" being seen as a dull grey (in the case of steel) on finished work. The line of intersection between the fractured surface and the surface in contact with the tool cutting face will be affected by the condition of the tool's cutting edge. If the tool edges are sharp, there will be a sharp corner over edge of the blank (Fig. 2-5). If cutting edges are worn, the workpiece will carry a burr of the same height and radius as the amount of wear (Fig. 2-6).

In addition to producing excessive burrs on the tool side of the work material, dulled cutting edges cause excessive radii on the opposite work surface and also demand a marked increase in pressure to break the metal. The fractured surfaces are rougher and may show many minute cracks which weaken the edge.

Burr height, even when not important from the standpoint of product quality, is often used to determine the optimum time for regrinding die tools as a precaution against tool breakage, to keep actual grinding time to a minimum, and to ensure maximum total production from the die tools.

It can be seen from the preceding illustration that neither the edges of the section punched out, or the sidewalls of the hole produced by punching, can be perfectly square with the top and bottom surfaces of the work material.

In most operations it is advisable to strive for a combination of conditions that will result in severing the metal about 30% by penetration and 70% by breakage. This can be seen on the work produced by the relative height of the bright and dull sections along edges cut.

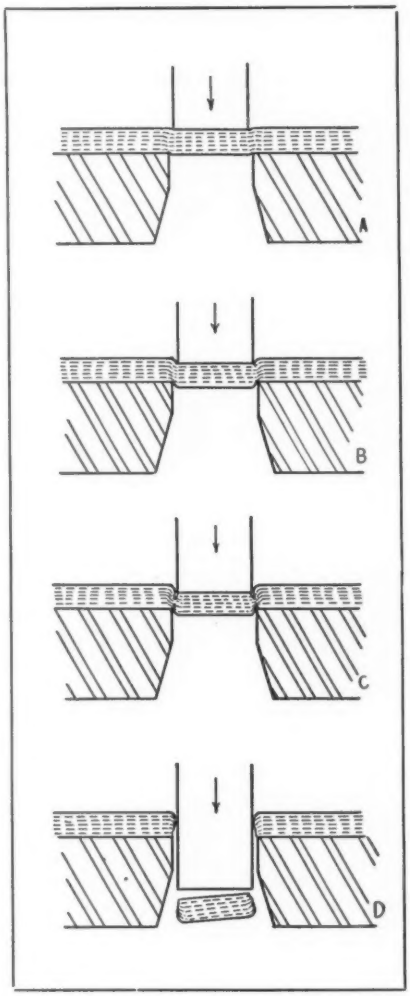


Fig. 2-3. Action of press cutting tools: A punch has just contacted the stock; B, punch has pushed stock ahead of it into the die opening; C, ultimate shear strength has been exceeded, and stock begins to fracture; and D, action is completed, punch is at bottom of stroke, and blank or slug has been severed from the surrounding metal.

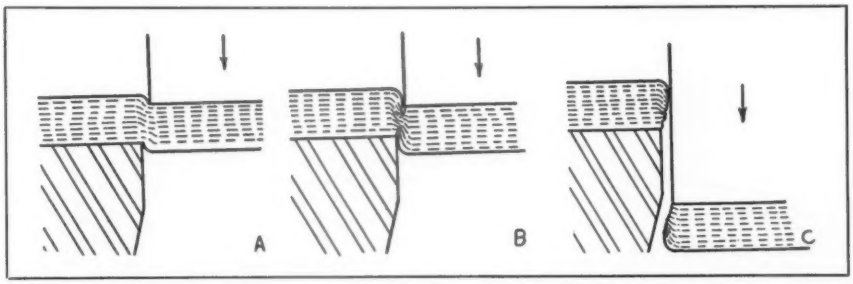


Fig. 2-4. Influence of shearing action on appearance of blank and surrounding metal: A, radii adjacent to the tool edges represent permanent deformation; B, depth to which the punch penetrates before fracture determines the extent of "brightness" along sheared edges; C, correct tool clearances will result in a "clean" fracture.

"Die Designing and Estimating"

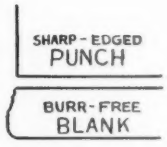


Fig. 2-5. Blank appearance resulting from sharp tool edges and proper clearances.

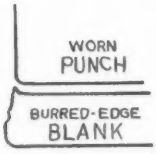


Fig. 2-6. Blank with burr caused by worn tools.

Depth of Penetration

The distance that a punch must sink into or penetrate the material before fracture begins, is variable. Although controllable to a degree, it depends largely on the rigidity of the work material and partly on its shear strength. That is, the more rigid the material the less it will deflect before fracture.

In presswork, this rigidity represents a resistance to deflection under compression and that under tension.

The material's shear strength represents the peak pressure required to rupture the material, this pressure being little affected by the material's rigidity although the latter will determine how quickly this peak pressure is reached.

Since a material's hardness is its most outstanding property and is most easily determined, it is often assumed that its shear strength and its rigidity increase proportionately with its hardness. Although not infallible, hardness can be used as a general criterion of rigidity and shear strength.

Thus, the greater the hardness of the work material, the more rigid it will be and the shallower the depth of penetration required to fracture it. This means that the fracture will occur earlier, with a faster build-up of the forces required to overcome the material's resistance to shearing. And, the greater the stock hardness, the more resistant it will be to shear (or, the greater the unit peak pressure required to cause fracture).

Thickness of the stock also has a similar relationship. The greater the thickness, the more rigid the sheet becomes and the lower the percentage of penetration required for fracture. Also, the higher will be the actual peak pressure required to cause fracture.

The problems that are encountered because of hardness and thickness of the stock can be controlled to a degree by changing the clearance between punch and die and by applying a shear angle to the one cutting edge. These two points will be discussed in turn.

Punch and Die Clearances

The amount of radial clearance between the cutting edge of a punch and the cutting edge of the die block (Fig. 2-7), is highly important to good presswork.

The primary requirement is that the clearance be uniform along the full length of the cutting edge (Fig. 2-8). If the clearance is less at one point than another, the quality of the sheared edge will be affected and will not be uniform for its entire length. Neither will the pressure be the same on both sides of the punch. Tool wear will be uneven and, if the clearance along one side becomes too small, the punch will probably break. It certainly will if the punch point should strike against the top surface of the die block.

Correct radial clearance can help provide one or more of the following benefits:

1. Clean fractures, with minimum irregularities and surface fissures, and with minimum taper along the fractured edge.
2. Maximum area of sheared edge being perpendicular to flat top and bottom work surfaces.
3. Minimum burr height.
4. Minimum press exertion.
5. Maximum tool life.

In actual practice, it is often necessary to sacrifice benefits No. 1, 2, and 3—to a degree—in order to gain benefits No. 4 and 5. Each job demands its own optimum combination of the above benefits.

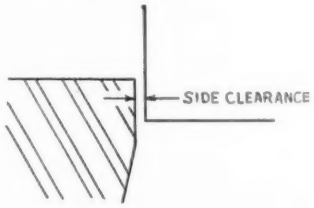


Fig. 2-7. Proper clearance is essential to good presswork.

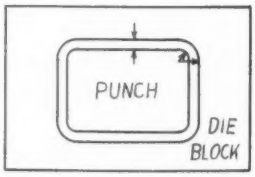


Fig. 2-8. Side clearance must be uniform along the full length of the cutting edge.

The table below gives recommended starting clearances which should be specified in the design. These allowances are for manufacturing and assembly tryouts and are subject to slight modification according to the results of die tryout.

The smaller the clearance, the greater the depth of brightness along the edges cut. This indicates a higher percentage of cutting and burnishing in proportion to breaking.

The clearance may, however, be so small as to be inadequate. If the stock is very thick, the fractured surfaces may be unusually rough and the metal around the punched hole may show many minute cracks leading from the edge. Power consumption will be higher and may, on heavy stock, be excessively high. The peak pressure required for fracture may exceed the normal shear strength of the material. Tool life will be unpractically short.

The larger the clearance, the lower the power consumption and the lower the peak pressure required to fracture the material. On hard metals where pieces blanked from heavy-gauge stock are large and quality of edge relatively unimportant, clearances up to 25% are sometimes employed to keep press exertion to a minimum. Large clearances are also used to reduce the pressure on delicate piercing punches; however, too much clearance on a piercing die will allow slugs to pop out of the die.

On the other hand, radial clearances may be so large as to create objectionable conditions for the job at hand. The greater the clearance, the more the unrestrained work surface is drawn in the direction of working force, forming large radii. These may be too large on precision work that requires sharper corners on that side of the workpiece. Opposite to this radius will be a burr, the height of which increases in proportion to the workpiece.

These burrs may be unacceptable on precision work and on work to be formed in a later operation. If too heavy, the burrs may even be impractical to remove by tumbling, trimming, or milling. Fractured surfaces will be inclined more and will be ragged, with minute cracks leading in from the edge.

In the case of material that is soft, ductile, or light gauge, excessive clearances often cause the blank to dish or will even draw the material without completely severing it.

Clearances that are normal for low-carbon steel are usually excessive for such materials as magnesium and stainless steels of the austenitic or chrome-nickel type. These materials are highly susceptible to work-hardening and should be sheared with as little clearance—and as little drawing of the metal—as possible.

Shear Angles

The shearing action of a press die designed for cutting can be greatly facilitated by inclining the cutting edge of either the punch or the die block in relation to the cutting edge. This is known as adding **shear** to the punch or die.

There are several ways of providing **shear**, but all have the object of shearing the work progressively rather than taking the full load of impact equally along the entire length of the cutting edge.

. . . Continued on page 58

PUNCH AND DIE CLEARANCES*

(Percentage of Stock Thickness)

Class of Work	Thin Rubber	Magnesium / Chrome-Nickel Steel	Phenolics / Glass Laminates	Copper & Brass / Chrome Steels / Soft Steel	Hard Bronze / Medium Steel	Hard Steel	Aluminum
Small and Close Tolerance Work	None		3%	5%	6%	7%	7%
Average Work		1% - 3%	4%	8%	10%	12%	10%
Large, Heavy-Gauge Work			5%	11%	14%	17%	14%

* 1. These values represent the difference between diameter of a round punch and that of the die opening.

2. In the case of rectangular or irregular-shaped punches or those that cut on one side only, clearance equal to one-half the appropriate value above should be allowed between the die edge and the corresponding punch edge for the full distance of the cut.

3. On irregularly-shaped punches, the distance between centers of corresponding radii on punch and die should be held constant.

4. On blanking operations, the necessary clearance allowance is subtracted from size of die block opening to determine dimension across end of punch.

5. On piercing operations, the necessary clearance allowance is added to the dimension across end of punch to determine that across die block opening.

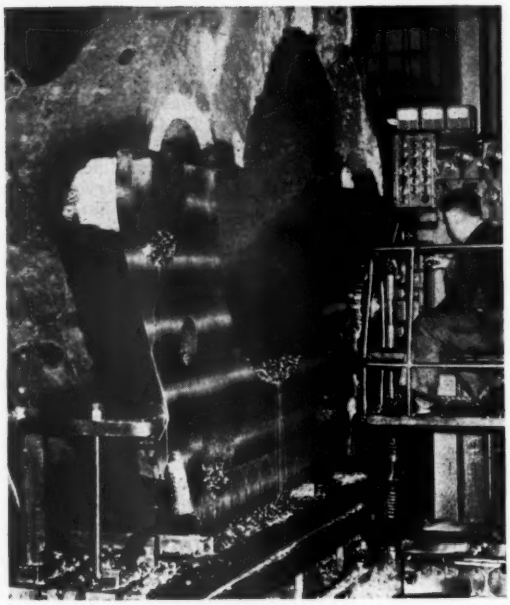
. . . Die Quench, from page 47

waffle pattern is developed by routing. An interesting detail is that a section is left in the material at this point and goes through the form die quenching and subsequent aging process. Before the grid goes into an assembly department, the section is removed and submitted to the Production Development Laboratory for photomicrographic study. In this manner, the heat treating of each part is checked and controlled.

After routing, the grid goes to the Machine Forming Department. Placed on special racks in the heat treating oven, the grid is brought up to temperature for a certain period of time. At this point, the metal is "relaxed"—its internal stresses completely relieved.

The process at this point requires agility and teamwork on the part of the operators of the big Birdsboro press, largest in use at this time at North American's Los Angeles plant and capable of exerting a force of 9 million pounds. As the oven doors open, the operators have thirty seconds to pick up the grid by a special handling device, move it out, swing it 180° and place it in position between the Kirksite die members in the press. The press moves down on the hot part. As the part is sealed into the die, water under firehose pressure rushes up through the die and around the grid members. The part, of course, "grows" under the heat treat. This amounts to about $\frac{1}{8}$" per foot in all directions, or about $1\frac{1}{2}$" on the FJ-2 wing grid. The great force exerted by the press keeps the part from shrinking back to the size it was when it came from the routing table.

This growth of the part under heat treat requires careful calculation by the metallurgist. First the template is made to the exact size of the finished part. Next, it's reduced photographically to a somewhat smaller size. The part is then routed out to the smaller size. Under heat treat, the part grows to the exact size of the original template. The 9 million pound squeeze exerted by the Birdsboro Press prevents the part from shrinking. The result is a part that has grown or stretched in fine and uniform increments, which accounts for the close adherence to contour and the absence of locked-in-stresses.



At the HPM plant, excess stock is milled from the face of the main cylinder casting for one of the new 7,000-ton presses.

After the part has cooled adequately to room temperature, it goes from the die quenching process to an oven for heat aging, then to Spar and Panel Fabrication for finish milling. It is then ready for installation in the wing.

Form die quenching is a revolutionary process in the forming of aluminum. The new HPM presses, the first of which is being installed at the Los Angeles plant are not restricted to this process, however. Various other types of forming can also be accomplished with them. Also, they are being made so that in the future it will be possible for two presses to be placed in tandem, thereby permitting much larger parts to be formed by the form die quench process.

Form die quenching is being used on almost all models of aircraft being produced in whole or in part by North American Aviation. The heavy grids proved to be the best answer to numerous design problems on the F-86H

The grid has been formed to the die contour. Quenching the hot grid while pressure is maintained keeps it from shrinking and warping.

Sabre and FJ-2 Fury, and the new process is the only way to make these grids on a production basis. New aircraft designs may use still other processes not yet in production use at North American Aviation.

The form die quench process is not restricted to the heavy grids shown in the illustrations for this article. Many smaller parts are being produced by this process, with proportionately substantial savings in manhours and with greater accuracy. On one typical part there is a unit saving of $16. These parts are turned out by hundreds. In many cases the process eliminates conventional drop hammer and power hammer forming of parts. The older forming methods relied on repeated blows to partially relieve internal stresses in the metal. By producing a part relatively free of internal stresses, the form die quenching process results in a considerably stronger part. The development of sonic airplanes and subsequent design of very thin wings made with very heavy, tough material has made the big presses valuable allies of the airplane producer.

The grid, formed to contour and properly cooled by die quenching, is now matched with the full-scale template.

Process Details

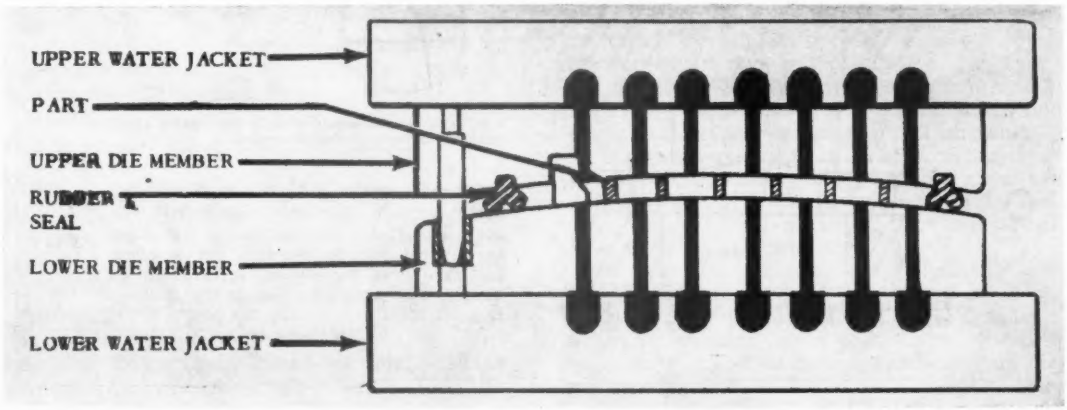
In the initial phase of the complete cycle, the workpiece is placed in a heat-treat furnace, heated to a specified closely controlled temperature, and held at that temperature until complete and even heating of the metal has been achieved. The heated workpiece is then removed from the furnace and quickly transferred to the press and positioned on the lower member of the form-die.

The upper die member descends and simultaneously forms and cools the part by conduction through the relatively cold die surfaces. For light-gauge parts (under .375" thickness), form-die members have sufficient mass for the tool surfaces to remain relatively cool during the normal production run. On heavy-gauge parts, such as the heavy wing grids previously mentioned, the upper and lower die shoes serve also as water jackets and are cast with void areas for coolant.

Water is injected under high pressure into the lower water jacket, through cored openings in the forming member leading to the tool surface, through the void areas of the workpiece and manifolded out through the upper forming member and the upper water jacket. It is assumed that a limit switch and solenoid

. . . Continued on page 86

In the case of large dies for "one-piece assemblies", die shoes also function as water jackets by having void areas cast in, with channels leading into cored openings extending through the forming members.



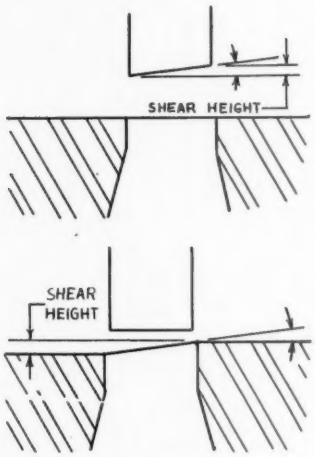


Fig. 2-9. Shear provided by inclining full cutting face of either punch or die block.

. . . Die Estimating, from page 55

The more common methods of applying shear are as follows:

1. Inclining the full cutting face of either punch or die block in relation to the plane of contact (Fig. 2-9). This is applied principally to punches that cut along one straight line.

2. Inclining the cutting edge to each side of center (Fig. 2-10) so as to permit cutting either from the center outward or from the ends toward the center. The former method is preferred since it helps hold the work and restrains work distortion. Flats should be provided at the initial points of contact, and a radius along line of intersection of the two planes to avoid fracture of the stock. This method is used principally for cut-off and parting operations and the shear is usually applied to the punch.

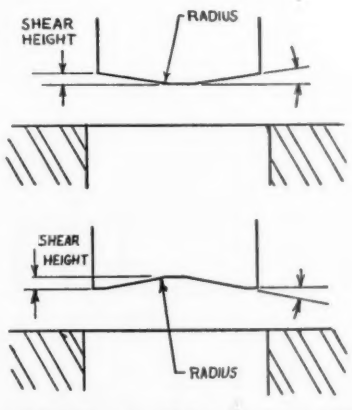


Fig. 2-10. Shear provided by inclining cutting edge to each side of center.

3. Grinding a concavity along the cutting edge (Fig. 2-11). This is similar to the preceding method, and is usually applied to the die block. Since the effectiveness of shear is largely lost near the center of the concavity, this method is seldom used for heavy-gauge stock.

4. Grinding a series of waves in the cutting face of the die block (Fig. 2-12). In a sense, this is method No. 3 applied to large, heavy blanking operations.

5. Providing a slow helix or spiral along opposite sides of a circular punch (Fig. 2-13). This method is used principally in piercing operations.

Shear is not used unless needed, and its benefits must be weighed against its disadvantages.

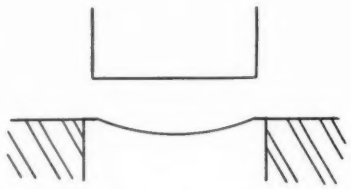


Fig. 2-11. Shear provided by grinding a concavity along the cutting edge.

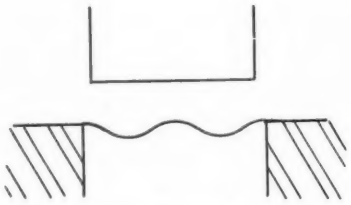


Fig. 2-12. Shear provided by a series of waves in the cutting face of the die block.

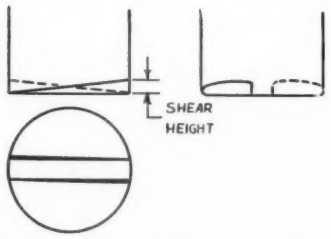


Fig. 2-13. Shear provided by a slow helix along opposite sides of a circular punch.

On the negative side, the application of shear usually increases the initial die cost. It distorts that portion of the stock in vertical alignment with the angular tool face since the severed metal tends to bend in the same direction as the inclined face.

Thus, shear on the punch will distort the punched-out section while shear on the die block distorts the surrounding stock. For this reason, the shear is generally applied to that tool which faces the area of stock destined as scrap.

Another point to be considered is the greater chance for dimensional error and variation since the dimension of the cut tends to increase in proportion to the angle of shear.

On the positive side, correctly applied shear angles reduce peak pressures and retard acceleration of pressure. The impact load is thereby reduced and longer tool life attained. Strain on the press is also lessened. In many instances the application of shear is absolutely necessary in order to reduce operating pressures to a point within available press capacity.

Whereas correct punch-and-die clearances provide 20% to 35% punch penetration before the stock fractures, the addition of shear permits punch penetration of 50% to 75% to complete severance of the material. This results in a smoother shearing action and cleaner edges with a higher degree of squareness.

Height and Angle of Shear

Considerable attention must be given to the shear height (Fig. 2-14). This height determines the amount of reduction in peak pressure, the amount of work distortion, and the increase in dimension of the cut.

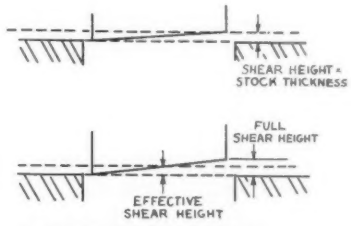


Fig. 2-14. Effective shear height.

On cuts where the ratio of stock thickness to length of cut is relatively low, a shear height equal to stock thickness is usually employed. With the shear applied from one end of the cut to the other, the shear angle is determined by the length of cut.

Shear heights greater than stock thickness are often used but, in general, are objectionable for several reasons. The amount of work distortion and the dimension of the cut increase in proportion to the shear height. In addition, the punch must descend farther into the die block opening in order to completely sever the material . . . and this added depth is equal to the shear height. The punch must also be withdrawn farther for effective stripping.

Fig. 2-14. Rake applied to the cutting face to reduce tendency of metal to bend away from the shearing force.

This extra travel of the punch may in some instances be a limiting factor as far as operating speeds are concerned.

In the case of short cuts on heavy stock, care should be taken not to obtain too high a shear angle since the ability of the tool to withstand the initial impact load may be affected. The shear angle probably should not exceed 30°.

On long cuts, compound shear angles or a series of waves can be employed to help equalize working forces.

The tendency of metal to bend away from the shearing force can be reduced to a degree by providing rake on the cutting face . . . inclining it a few degrees off that cutting edge on which shear is applied (Fig. 2-15).

DIE DESIGNING and ESTIMATING, 4th Edition

For many years, DIE DESIGNING and ESTIMATING has been a best seller and, for too long a time, has been sold out. It has been widely used in schools and apprentice programs, for both classroom and on-the-job training, and by die making and die engineers as an authentic reference and refresher.

It will soon appear in a new, greatly expanded and enhanced edition of three times its former size.

First available (by the time you read this) will be the section devoted to the Dannes method of die estimating. This has become more and more valuable by virtue of having been shop-proved and found not wanting over many years.

Although as basic as the makeup of the air we breathe, the new edition of DIE ESTIMATING has new illustrations and the text and working examples have been revised in terms of today's most advanced die engineering procedures.

The complete work, DIE DESIGNING and ESTIMATING, will be next off the press. The DIE DESIGNING section has been completely torn down, overhauled and reassembled. Much new material has been incorporated.

There are greatly expanded chapters on blanking, piercing, and cut-off dies, bending and forming dies; to the chapter on drawing a chapter has been added on deep drawing; other added portions cover temporary and short run dies, selection of die materials, with many new pages devoted to job planning, stock layout, and press tonnage determinations.

The new 4th edition of DIE DESIGNING and ESTIMATING is destined to continue as an invaluable die engineering tool; encyclopedic in scope, authentic in source material, and thoroughly proved as a most practical shop text and teaching aid.

THE PLASTIC MODEL

...as an Engineering Tool

by Arnold P. Saviano

Supervisor, Plastics Division
CREATIVE INDUSTRIES OF DETROIT
Detroit, Michigan

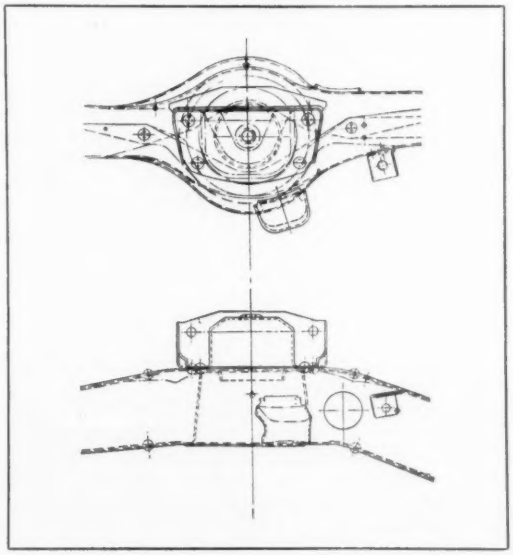
PLASTICS OF VARIOUS TYPES have been used in making production parts for the automotive industry for many years. Their use has become commonplace and has opened up new vistas for design, particularly in developing various ornamental features.

In the past few years, plastics have been developed especially for use in the production engineering field. Plastic dies have long proven successful in the aircraft industry, and many of the automobile manufacturers are now accepting this type of tooling on the basis of service, time savings, and maintenance cost reduction.

Duplication of die models by the plastic method is coming into common use, as the necessary knowledge of their construction is acquired. These duplicate die models are used as production aids in setting up assembly jigs and fixtures, while the original mahogany model is being used for Kellering purposes. The tool engineer is becoming more and more plastic minded in the design of various types of jigs and fixtures. Fibreglas, combined with poyester resins, is being used to produce sturdy, lightweight drill jigs, routing fixtures, spotting fixtures, and dies.

This article is based upon a paper delivered by the author before the recent Technical Convention of The American Society of Body Engineers, Inc.

Fig. 1. Orthographic Drawing

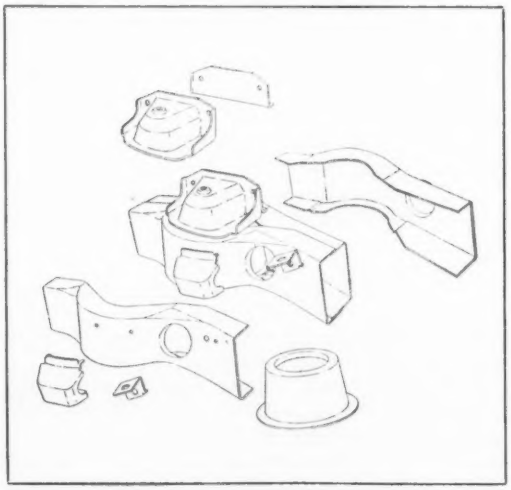


Whenever a new method or process has been developed in any field it has been customary for claims of a somewhat exaggerated nature to be made. Plastic tooling has gone through this stage and the good wheat of sound results has been separated from the chaff of erroneous claims.

Now, another use for plastics has been developed as an aid to the production and tooling engineers. The theory of its use might best be explained by the statement that the foundation of all engineering, once the original design concept has been established, lies in the various drafting phases. It is probably safe to assume that the majority of the people who read this paper are either draftsmen at the present time or have been draftsmen at some stage of their careers. It is therefore safe to assume that most of us are familiar with problems involved in visualizing complicated portions of any new product as it progresses through the design and layout stages.

Simple parts ordinarily present no problems and can be analyzed directly on a design layout. Parts which are complicated in them-

Fig. 2. Perspective Drawing



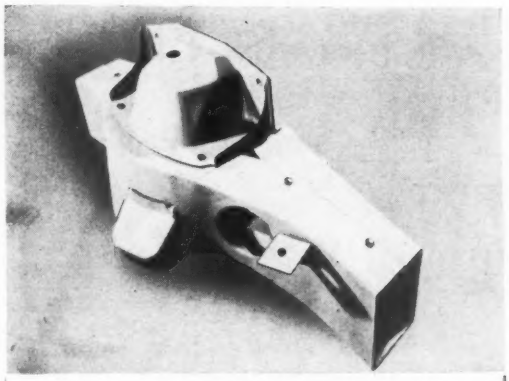


Fig. 3. Actual Model

Fig. 4. Wood Forms and Plastic Parts

selves, or which are involved in complicated assembly conditions, are difficult to analyze on the layout even for men working right on the design.

Need for a New Tool

Until the present time there has existed a need for a new engineering tool to be used in the early design stages, which would help clarify and expediate problems relative to engineering design and production processes.

In the past, many such problems have not been fully visualized or solved until costly pilot models had been built. It is, of course, highly desirable to incorporate as many design improvements as possible during the early stages at a time when the cost of making a change is relatively small.

It has long been recognized that it is much easier to analyze a problem when you are in possession of a model which can be held in your hand, and twisted and turned and viewed in various positions. This is frequently called "thinking with your hands" and represents the easiest way for most of us in this line of work.

Increasing complexities of design have made the need for accurate study models more apparent. It is important that these models be prepared quickly and that it be possible to incorporate changes in a matter of hours.

The greatest need for study models exists in the early stages of a program. The Engineering Department carries the responsibility for product design as it relates to function, appearance, performance, and other characteristics. From the engineering standpoint many optional designs may be perfectly acceptable; while, from the viewpoint of the manufacturing divisions, the choice may be narrowed down to one or two. Piece cost, manufacturing processes involved, availability of machinery or facilities, special labor requirements, and material handling are among the many determining factors.

It is therefore highly desirable that some compromise of design acceptable to the representatives of the various tooling and manufacturing divisions be incorporated in the Engineering layouts and drawings at the earliest possible moment.

Present Methods Used

For many years it has been customary for draftsmen to construct reasonable facsimiles of the various parts by cutting out cardboard models, and fastening them together with masking tape or other means. From these individual models it is possible to make some design decisions relative to the easiest method of fabrication of the parts, and to analyze the various methods of assembly. Models have also been fabricated from aluminum foil, lead foil, and other similar materials.

Any of these materials is suitable for those parts which are curved in one plane only, but we have been faced with almost insurmountable difficulties in preparing models of parts which have compound curvature, or parts which are commonly classed as "draw-die" parts. Cardboard models are limited in value because of obvious inaccuracy, difficulty of fabrication, lack of strength, and the limitation imposed by single models when many duplicates are needed.

Perspective sketches have been a big help in the early stages of design, and will continue to be a help, but such sketches do not give the users the opportunity to "think with their hands" (Figs. 1 and 2). The handmade, sheet-metal cross-sections and complete pilot models customarily used are tremendously valuable

. . . Continued on page 68

OPERATING COST CONTROLS OFFER

...Increased Productivity

...Dollar Economies

...Less Scrap and Waste

There is a growing realization by management in all size manufacturing companies that the weakest link in organization is at the foreman level and concerns the direct activities which the foreman controls.

In my opinion good operating control must begin at the foreman level and be carefully built from this level to the top. Exactly the reverse is the usual thinking in establishing the orthodox systems of operating control.

How Are We Doing?

Here are a few questions that management of any size plant should ask: Do our foremen know the degree of productivity in their department? Are workmen under our foreman's supervision producing at 100% performance, or is their pace nearer to 50% or 75%?

Are our foremen interested in improving practices in their departments? Can management measure the results of better performance and give "a pat on the back" where deserved? Are our foremen interested in keeping labor costs at a minimum?

Are crew sizes kept at the correct point for most efficient operation, or are extra workers maintained on payrolls to act as buffers against absenteeism? Do our foremen know what the correct size of their crew should be?

Are our foremen interested in preventive equipment maintenance to keep breakdowns and delays at a minimum? Are they interested in scrap reduction and waste elimination? Are they quality minded as well as production minded?

Do they know what their normal scrap losses should be? Do they know the costs of the supplies and power they use?

Unless management can answer YES to the above questions, any program of operating control is ineffective, and operating costs of necessity must be from 10 to 25% higher than they should be. Foremen and department heads are the men responsible for spending most of the money that goes into production cost in a manufacturing plant. If costs are high, it is because these foremen and department heads have spent more money for labor, material and departmental expense than the production in their departments justified or, conversely, the production was too low to justify the money expended.

In most factories, the direct workers are fairly well controlled, but the indirect labor and departmental expense are relegated to "overhead" and more or less forgotten until the monthly accounting is completed. This is too late for effective control. As a matter of fact, it is just as feasible to control indirect labor and expense fully and effectively.

The Foreman vs Small Business

Let's for a moment compare the foreman of a manufacturing department with the proprietor of a small business. All too often the foreman in charge of a department's operation concerns himself mostly with directing employees and getting out production. He is a straw boss and no more.

If production lags, he thinks in terms of getting more help. He is completely unconscious of costs of excess labor, tools, power, repairs to products and maintenance. He lets inspection worry about quality. Scrap is scrap; and oils, lubricants, supplies, grinding wheels, abrasives, perishable tools, etc., are items furnished to him and they're items to be used.

He gets cost conscious only when his superiors call him on the carpet and then he's liable to go to the other extreme and cut the use of supplies, power, manpower and tools below the minimum needed for efficient pro-

by M. K. Sheppard
Management Consultant
M. K. SHEPPARD & COMPANY
Cleveland, Ohio

Mr. Sheppard is well equipped to write on production cost controls because of his engineering and accounting work with such concerns as Robert Heller & Associates, Inc., U. S. Steel Corp., Carnegie-Illinois Steel Corp., Ernst & Ernst, and Thompson Products, Inc.

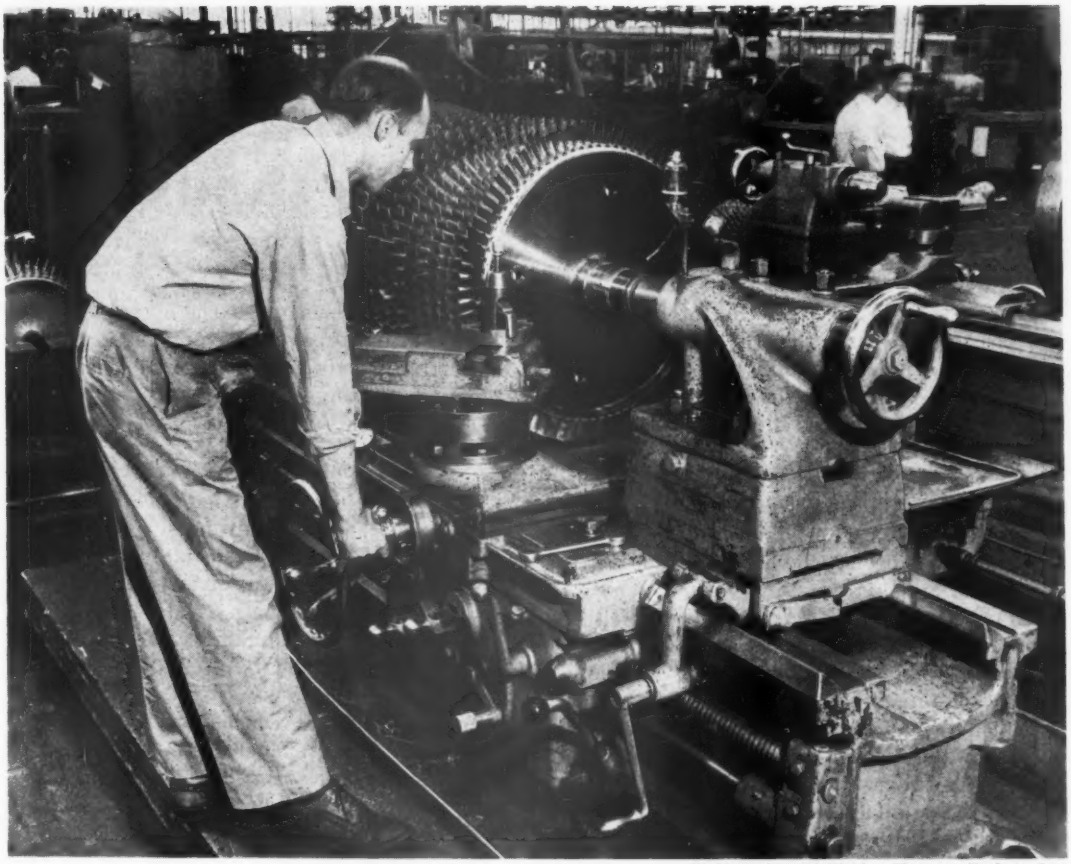


Photo courtesy Jet Division, Thompson Products, Inc.

In the plant of Thompson Products, Inc., manufacturer of auto and aircraft parts, "**this day-to-day budget control was a major factor in enabling the company to reduce the cost of principal jet plane parts by 48 per cent**"

duction. In other words, he never knows when he is right.

The propietor of a successful small business on the other hand is well versed in every phase of his operation; he has to be in order to stay in business. He issues the purchase order and checks incoming supplies. He reviews every invoice received, he signs the checks and he directs his help. He evaluates which employees are productive and which are not. Subconsciously he sets standards for all his costs from his direct knowledge and working experience in his small enterprise. Only efficiency will show him a profit.

The Foreman as a Proprietor

A comprehensive plan of operating cost control makes each foreman in a sense, a proprietor. It makes each operating department a small business within a business, with positive budget standards for each item of production cost. To operate within the budget standard is to operate his department at a profit. To fall below budget standards is to operate at a loss.

The Sheppard Plan of Operating Cost Control is designed to give the foreman, on his own departmental basis, all the current cost information and daily performance reports which he needs in order to function as effectively as possible. It provides management with the facts needed to judge the effectiveness of each department and to decide where and what corrective action is required.

A Thompson Products Installation

Several years ago this writer installed his operating control in Thompson Products, Inc., Cleveland auto and aviation parts manufacturer. In an article published in The New York Journal of Commerce, the Chief Industrial Engineer of Thompson Products "said that this day-to-day budget control was a major factor in enabling the company to reduce the cost of principal jet plane components by 48% in the period from March, 1947 through September, 1948.

. . . *Continued on page 70*

This-up-to-date treatment of hardness testing equipment and methods will help you to tie in the "how", "when" and "where" of hardness testing to work in progress.

Hardness Testing Equipment and Methods

by John E. Hyler

There is no precise definition of hardness, and possibly no perfectly true concept of it, though it is a quality definitely known to exist. Various ideas of testing for hardness in metals have been advanced through the years, including tests made by the machinability route. Checkups have been made on resistance to abrasion, sometimes spoken of as wearing hardness. Resistance to scratching has sometimes been made a criterion of hardness tests.

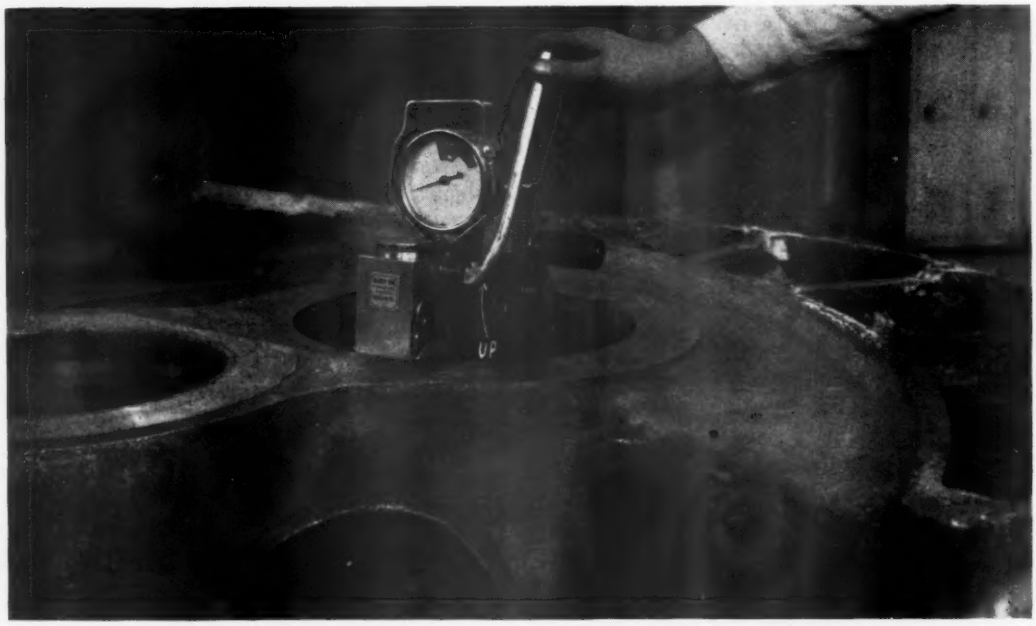
All of these, however, are highly limited in their practical applications, therefore of only limited worth. For the most part, hardness testing equipment in wide use today operates either on the rebound principle, or on resistance shown by a given metal or material to permanent indentation when subjected to either a static or dynamic load.

Hardness testing is widely employed for checking uniformity of result of some given treatment known to alter hardness of materials. Heat treatment is the outstanding instance of this type. However, alloying, case-hardening, forming and other treatments may sometimes be supplemented to good advantage by a subsequent hardness test.

Correlations With Other Properties

It is a well known fact that certain correlations exist between hardness and various other desirable or non-desirable properties in metals. Hardness in a given material, for instance, bears a certain relation to tensile strength, also to machinability. Such correlations are not sufficiently well understood to allow using a hardness test as the actual criterion, unless it be with a very considerable allowance for discrepancies. However, knowledge of such correlations is often useful within limits, though hardness testing is usually conducted in the light of its own value.

The general theory that hardness may be measured by resistance of a material to pene-



The hardness tester shown in use here is one which may be employed for both portable and stationary use. It is a Brinell type tester which makes standard tests, putting a load of 3000 kg on a 10 mm ball. The removable test-head can be operated in any position, even upside down. The device is here seen testing the hub of a locomotive driving wheel.

Photo courtesy Andrew King.

tration or indentation is foundational in the design of various hardness testing instruments. The pentetrator employed may be a ball, (as in the Brinell Test) or it may be in the form of a plain or modified cone or pyramid, generally formed from a diamond. Generally, a static load is applied to produce the indentation. It is possible to either measure the load that would produce a given depth of indentation, or to measure the indentation produced under a given load. The latter, however, is the means generally employed.

Many consider hardness testing to be essential not only before and after heat treating, but before machining in many cases, also when receiving raw materials into the plant or warehouse. Many times, where relatively intricate dies are being employed, hardness tests are imperative, to protect them against too-hard material. In many instances it is necessary to check changes in metal hardness after welding or flame cutting. Often, far better machining results are obtained by continually checking the hardness of metals passing through the production line.

Above and beyond these factors, hardness tests have a certain amount of value in metal design. While there is definite danger in considering a hardness value anything like a universal constant, it cannot be denied that there is some connection between hardness and compressive yield strength; that there is some relationship between hardness of a metal and its drawing and forming characteristics; some relationship between hardness and wear resistance; and a definite relationship between hardness and machinability.

Designers Employ Correlations

In the absence of better criteria, designers have often relied in a considerable degree on hardness tests and their correlations with these factors. In many cases, clues to defects in manufactured parts are obtainable through hardness tests. It is now such a simple matter to make adequate hardness tests that such testing equipment is assuming a place of importance in practically all plants. After long and rigorous service, a hardness tester is not as reliable as formerly. For that reason, in many places these testers are regularly inspected and calibrated or corrected.

Different instruments are available which make use of the principle of energy absorption of impact loads, or so-called rebound hardness. One of the earliest testing instruments of this type was the direct-reading Scleroscope, which quickly gained a great deal of popularity, and is popular until now. The direct-reading Scleroscope is equipped with a cylindrical barrel within which a diamond-pointed hammer travels vertically in making the hardness tests. This diamond-pointed hammer is

A direct-reading Scleroscope shown setup for hardness testing on gears. Note Scleroscope is supported by a swinging, jointed arm, which allows it to be brought to any desired position for testing. Gear being tested is held in a vise as shown.

Photo courtesy The Shore Instrument and Manufacturing Company.

Here is seen a comparator type of hardness tester in use, which operates on the rebound principle. This tester incorporates an accurately-machined hammer, tipped with non-elastic Carboloy, and of known weight, which is allowed to drop through a measured distance, to rebound and be held at the top of its bounce by an ingenious magnetic clutch.

Photo courtesy A-H Company.

allowed to fall within the glass tube from a given height, the point of the hammer striking against the surface of the part being tested.

The diamond point is rounded to a radius of about .01". A graduated scale, provided on this instrument, gives accurate readings on either soft or hard material, without any necessity for changing hammers. Readings are obtained by watching rebound of the hammer, and reading the height on the scale to which it will bounce. The amount of the rebound depends both upon resilience of the hammer and that of the material being tested. A certain amount of material deformation takes place when the hammer strikes. This is a very important factor in the reading obtained.

When the hammer falls on a soft surface, it penetrates that surface to a degree before rebounding, leaving a tiny indentation. In making this indentation, part of the energy of the fall of the hammer is neutralized, and only the remainder of the energy manifests itself in rebound.

Harder Material Gives Higher Rebound

When the hammer is dropped on a very hard surface, the size of indentation it leaves is negligible. In consequence, less energy is absorbed in making it. It necessarily follows that rebound of the hammer will be much higher than where softer material is being tested. Thus, height of the rebound is taken as the measure of the hardness of the specimen. However, were it more convenient to do so, the size of indentation made could be measured and used to compute hardness of the material.

In testing various small parts up to 3" high, this kind of instrument is mounted on a clamping stand provided for the purpose. However, for testing large and unwieldy parts, it may be mounted on a swing arm and post, provided by the instrument manufacturer. In some instances, where very heavy objects and structures (which cannot be conveniently moved) are to be tested for hardness, the Scleroscope may be applied by hand. In any case, the lower end of the instrument barrel is brought firmly in contact with the test specimen. By squeezing a rubber bulb provided for the purpose, the diamond hammer is released from its elevated position.

Hammer rebound on the first bounce indicates specimen hardness. The hammer is then raised, preparatory to the next test, by again squeezing and releasing the rubber bulb. In operation, an operator learns to focus his eye several points below the general area of

. . . Continued on page 80

Photo courtesy Steel City Testing Machines, Inc.

Seen in operation here is a manually-operated bench-type Brinell testing machine, which employs the multi-beam and dead weight principle. Weights are accurately calibrated for loads of 500 to 3000 kgs. A suitable hydraulic dashpot is incorporated, to eliminate any shock as the load is applied.

Photo courtesy Riehl Testing Machine Division, American Machine and Metals Incorporated, Inc.

This is a hydraulic Brinell hardness tester of the dead-weight type. Although hand operated, it equals various power-driven machines in convenience and ease of operation. This machine makes use of a hydraulic accumulator. The distance between the ball indenter and supporting platens is adjustable between zero and 12", by means of the handwheel seen at the lower end of the table post.

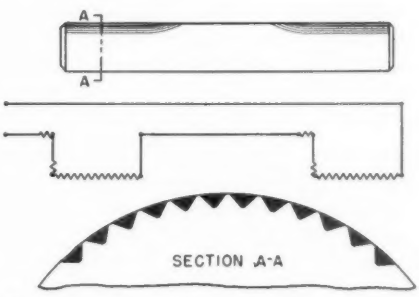
Above:
CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine with automatic fixtures for milling the serrations in both ends of brake pedal shafts, at a production rate of 123 per hour.

Completely Automatic Setup for Automotive Part

with defense application possibilities

Costs descend vertically and operators are happy with the automatic equipment illustrated here. It's a CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine, with a magazine type fixture. All the operator has to do is stack work on a shelf; the machine and fixture take over the job of loading, clamping, milling and ejecting. ¶In one operation, serrations on both ends of brake pedal shafts are automatically milled with this setup. The machine's hydraulic rise and fall feature is the deciding factor in taking these two milling cuts. After taking the first cut the spindle carrier automatically rises, the table repositions, and then the carrier advances down to accurate depth for the second cut. Production averages 123 shafts per hour. ¶CINCINNATI No. 0-8 Automatics have many features of value for this type of work, and our Application Engineers have the know-how to tool them up to your requirements. Of course, these machines are in short supply right now, but you might like to know more about them for future applications. Ask for catalog No. M-1607-1.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Above:
Drawing of part and diagram of automatic cycle.

Part name	Brake pedal shaft
Material	Steel
Operation	Mill serrations, both ends
Cutting speed	110 ft. per minute
Table feed	12" per minute
Production	123 per hour
Equipment	CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machines, with automatic fixtures

Right:
CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine. Catalog No. M-1607-1 contains complete specifications.

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SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

. . . Plastic Models, from page 61

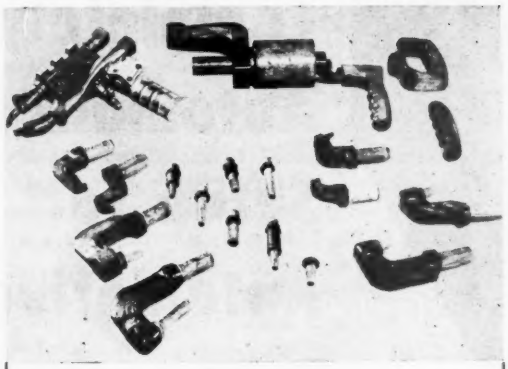

Fig. 5. Cast Parts

Fig. 6. Scale Model

and cannot be replaced, but are costly and take many weeks to produce. It is desirable to postpone the making of these sheet-metal models until the design has crystallized and most of the "bugs" have been removed.

A New Method Is Developed

A new method of producing three-dimensional models in any scale desired, at comparatively low cost, and in time to be of full value to the users has recently been developed. This medium in general involves the use of plastics. Certain types of plastics, such as U. S. Rubber "Royalite" and the Bolta Company "Boltaron" have proved to be quite satisfactory. Models made from these materials can be formed into compound-curvature shapes with a reasonable degree of accuracy.

What is rapidly becoming an almost standard method of procedure is as follows:

1. Using Engineering layouts or detail drawings for dimensional information, soft wood models made to ¼ or ⅜ scale are quickly made to the "inside of metal" line of each sheet-metal part.
2. The plastic material is heated and placed over various types of forms and drawn down to shape by vacuum blanket and by other forming methods.
3. The plastic parts thus obtained are trimmed to show flanges, cut-outs, holes and other necessary information. The results are parts which are accurate facsimiles of the future production parts, made to any scale desired (Figs. 3 and 4).
4. Parts which in production are other than sheet metal, such as castings and forgings, are quickly duplicated by pouring the proper type of liquid plastic into a simple mold (Fig. 5). The component parts are then fastened together by means of cement, screws, or other types of fasteners (Fig. 6). Location of spot welds are frequently marked in the proper places.

The dimensional scale to be used on the models is generally determined by the actual size of the part and the use to which it is to be put. Typical cross-sections and like models are generally made full-scale, although complete assemblies such as automobile bodies are made ¼ or ⅜ scale. Small-scale models are much more easily transported and handled at meetings around a conference table.

Duplicate models can be obtained very easily, once the first model has been made. Duplicates can be sent to outlying branches, and many problems discussed on the telephone with complete understanding on the parts of people at both ends of the line (Fig. 7).

The component parts of an assembly model can be made of different colored plastic to aid in distinguishing between them, or transparent plastic can be used for the outside parts so that the interior construction can readily be seen. Zones "A", "B", "C", etc. are sometimes marked on duplicate sets of models, which together with color coding of parts makes it easier to conduct a telephone conference.

Now that this medium has been developed, it has been somewhat surprising to note the number of people who have a great use for such models. It is quite obvious that when 10 to 15 representatives of the various departments are called into consultation, it is difficult to obtain practical decisions by analyzing layouts and stacks of related blueprints, even though perspective sketches have been prepared. Since the plastic model can be picked

. . . Continued on page 86

PRATT & WHITNEY "KELLERING"

Key to PRECISION MOLDS and DIES FOR BETTER PRODUCTS

Unequalled for SPEED, ACCURACY, ECONOMY

PHOTO COURTESY OF INTERNATIONAL MOLDED PLASTICS INC., CLEVELAND.

Pratt & Whitney-KELLER Machines are tracer-controlled millers that faithfully duplicate the shape of any master form or pattern. Very complicated shapes are duplicated as easily and accurately as simple work. Molds and dies of every type can be machined much faster than by any other method, and very little hand finishing is required.

The complete P&W-KELLER line includes models to accommodate a very wide range of work sizes. The Type BL — shown above machining the mold for the platter in this quality plastic dinnerware set — is a versatile machine specifically designed to handle a wide variety of small and medium sized jobs economically and efficiently.

Learn how a Pratt & Whitney-KELLER Machine can lower your die and mold costs and increase your profits. Send today for your copy of P&W Circular No. 490-2. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you or direct to West Hartford.

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- Automatic Duplicating Machines for Forging Dies
- Automatic Duplicating Machines for Bottle Molds
- Cutter and Radius Grinders
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CUTTING TOOLS

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- Milling Cutters (all types)
- Reamers (all types)
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MACHINE TOOLS • CUTTING TOOLS • GAGES

. . . Cost Controls from page 63

DAILY DEPARTMENTAL BUDGET REPORT

Division _____ Dept. _____ No. _____

Foreman _____ Date Issued _____

MACHINE PERFORMANCE DATA	CURRENT	CUMULATIVE	MACHINE PERFORMANCE DATA	CURRENT	CUMULATIVE
Potential machine hours A	2248	8992	Machine capacity % B/A	30	28
Budgeted machine hours B	670	2546	Machine perform. % B/C	79	78
Actual machine hours C	845	3251	Base hours: machine/man	612	2318

ACCT. NO.	DESCRIPTION	LABOR HOURS Date: 2/5/51 BUDGET	ACTUAL	Over Under	% Perf.	Period: 2/1/51 BUDGET	2/5/51 ACTUAL	Over Under	% Perf.
101	Operating Labor	465	566	101	82	1754	2118	364	83
101	Special Orders	34	40	6	85	147	169	20	88
101	Samples								
102	Inspection	69	85	16	81	207	255	48	81
102	INSPECTION	69	85	16	81	207	255	48	81
	TOTAL PRODUCTIVE LABOR	499	606	107	82	1901	2285	384	83
103	Set-up	51	54	3	94	209	221	12	95
104	Repairs to Product		14	14	—		49	49	—
111	Idle Time		10	10	—		41	41	—
112	Breaking in New Help						18	18	—
113	Maintenance of Set-up	4	4	—	100	13	13	—	100
114	Other time Paid—Not worked								
129	CLEANING MEN	3	3	—	100	6	6	—	100
	TOTAL NON-OPERATING LABOR	58	85	27	68	228	348	120	66
	TOTAL LABOR	557	691	134	81	2129	2633	504	81
121	General Indirect Labor	81	64	17	126	304	255	49	119
124	Process Inspection	16	23	7	70	60	97	37	62
125	Supervision & Clerical—Hourly								
126	Inspection Supervision—Hourly								
127	Cleaning Machines								
	TOTAL NON-PRODUCTIVE LABOR	97	87	10	111	364	352	12	103
	TOTAL CONTROLLABLE LABOR	654	778	124	84	2493	2985	492	84

TOOLS, SUPPLIES, MAINTENANCE AND MISCELLANEOUS - DOLLARS

		PERIOD:		TO		PERIOD:		TO	
305	Oils and Lubricants	64	33	31	194	243	33	210	736
306	General Supplies	35	28	7	125	132	78	54	169
307	Grinding Wheels & Abrasives	43	27	16	159	162	117	45	138
801	Maintenance—Machinery	245	199	46	123	927	515	412	180
802	Maintenance—Tools	83	129	46	64	313	328	15	95
803	Maintenance—Instruments	19	8	11	238	70	51	19	137
807	Tools Used								
809	PERISHABLE TOOLS USED	55	2104	209	21	209	349	140	60
819	Misc. Factory Expense	2		2	—	5		5	—
	TOTAL	546	688	142	79	2061	1471	590	140

	Scrap In Pieces	353	—	353	—	1253	—	1253	—

An example of the daily budget report form.

"He said that Thompson's budget method is to set-up factory goals for the divisions which represent the best possible efficiency that could be achieved. The budget sheets are also flexible, so that they will tell the cost for any volume of work scheduled. For example, it will give at a glance the number of men of various skills which must be employed in order to turn out a set number

. . . Continued on page 72

WE FORESEE YOUR DIEMAKING NEEDS ...and meet them!

More than 30 years' *past* experience in supplying diemakers' needs has taught Danly how to foresee *future* needs. In almost every instance, there are *standard* Danly Die Sets and *standard* Danly Diemakers' Supplies to meet your diemaking specifications.

You can rely on Danly's reputation for precision and dependability when you start your tooling program. You can be sure of prompt delivery from completely stocked Danly branch assembly plants located in nearly every major toolmaking center.

So save tooling time . . . get into production faster . . . insure longer production runs . . . with Danly Die Sets and Danly Diemakers' Supplies.

FAST,
COMPLETE
SERVICE!

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DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
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A NATIONWIDE BRANCH PLANT SYSTEM

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***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 East Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock*

. . . Cost Controls, from page 70

of units, as well as the pay that would be due them. It would also show all other types of factory costs, such as the materials and for inspection, for varying production schedules." And he said "that the way the budget control works it amounts to a case of doing the budgeting from an engineering standpoint, or from the factory on up as opposed to budgets run from the management on down."

Objectives

The Sheppard plan has two primary objectives:

(1) To increase the productivity of workers and thereby reduce operating costs.

(2) To improve the management skill of supervisors in better planning of operations, elimination of waste of all kinds, increased efficiency and continual improvement of operating methods.

Procedures

The procedure for installing this plan consists of four steps:

(1) The setting of preliminary budget standards for each item of departmental cost.

(2) The compilation and issuance of budget reports showing actual and budgeted expenditures.

(3) The guiding of foremen in performance and method improvement through the use of budget reports.

(4) The continual refinement of budget standards through engineering analysis and study until engineered budget standards are evolved.

A Typical Example

Now let's take a typical metal working plant to show you how this system can be put into operation.

The first step in establishing an operating cost control system, once management has approved the idea, is to begin with the foreman. He is the key man in the entire plan. Carefully explain to the foreman the objectives of the plan and show him how budget standards will enable him to operate his department with all the information at his fingertips, just as a proprietor of a small business operates his enterprise.

Explain to the foreman that it is vital to set reasonable "yardsticks" or budget standards for determining the amount of **money, manhours, machines** and **materials** required to make the products he is expected to turn out. Explain to him that once these reasonable yardsticks are determined, his performance will be reported back to him in terms he will understand; in short, how well he did with what he had to do with.

Budget Control is not Policing

Make certain the foreman understands that the budget control system is not a top management "policing method" for foremen. Show him that budget yardstick is for the foreman's own benefit and is designed to enable him to work against reasonable goals in the use of his men, money, machines, and materials. Point out to the foreman how the budget control system shows him daily, in actual quantities and dollars, where he is making forward progress in his utilization of the men, money, machines and materials at his command.

Setting Budget Standards

The setting of budget standards is practical engineering. It involves determining, and cross checking, with the foremen, the accounting department and the standards department the reasonable expectancy of a skilled man at a machine or bench; how long it should take to set up machines, how many pieces per hour, per worker and per machine at operating capacity. Where existing information is not complete, some time studies may be required.

In setting these budget standards we always aim to find 100% operating capacity or the best that can be reasonably expected with the men and equipment that we have. This is important. We do not attempt to define 100% capacity based on new equipment, if we had it; or higher skilled workmen, if we had them; or more money, better materials, if they were available, but simply what is best that can be consistently done with what we have. This is not an IF system but a HAVE system.

Daily Report Forms

Once budget standards are established for the department, a report form is designed to meet the specific needs of the department. This "tailor made" form provides a means for showing daily the budget goals and the actual attainment. This performance is measured in gain or loss against the budget standard for the actual pieces turned out.

Budget goals vary daily depending upon the flow of work through the department. Consequently the performance gain or loss pertains only to the work performed and can show a progressive percentage of gain where work or expenditures are being effectively controlled even though the department is operating at one-half or one-third of capacity.

. . . Continued on page 75

WESSONMETAL
TUNGSTEN-CARBIDE

WESSON TOOL HOLDERS

First . . .

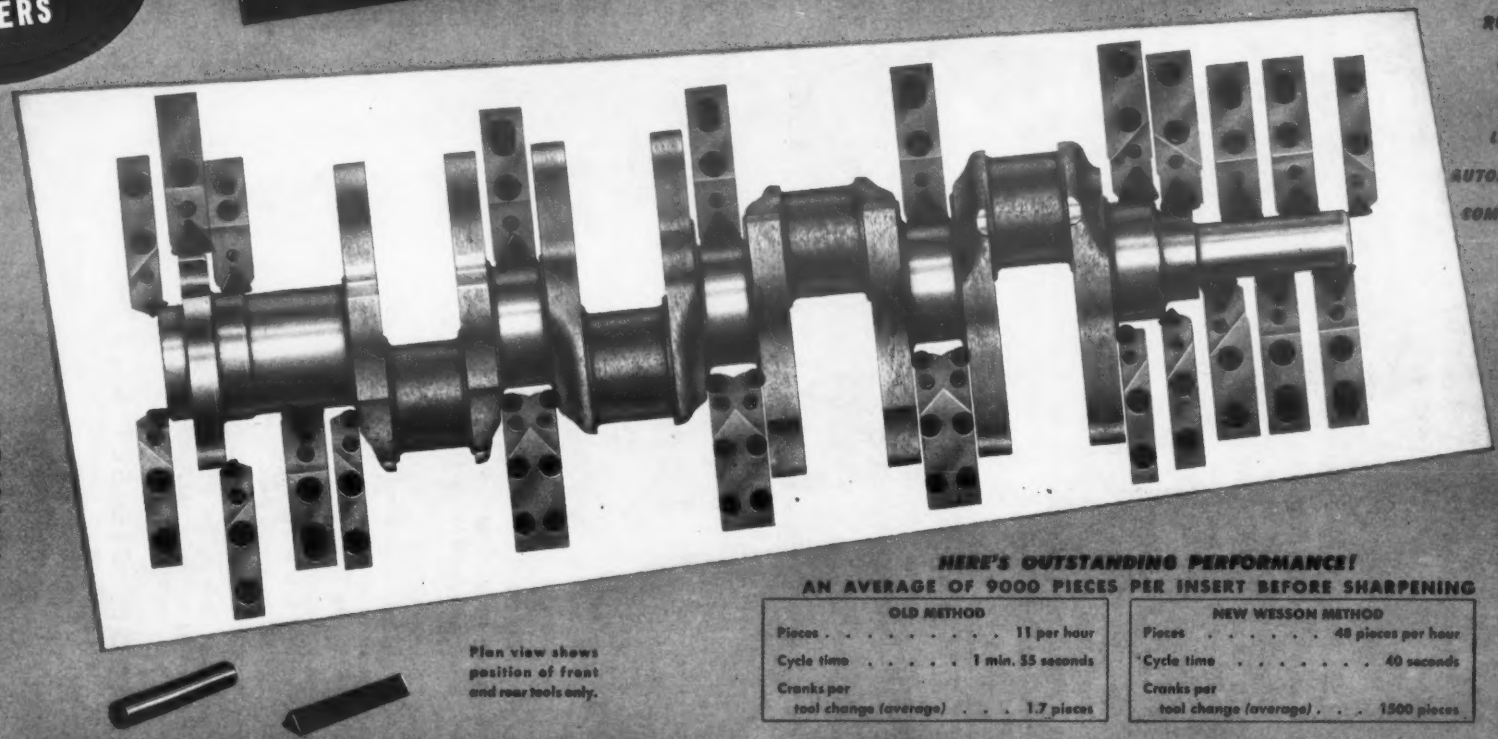
. . . TO TURN CRANKSHAFTS

with CARBIDE INSERT TYPE TOOLS
USING WESSON BAND TYPE TOOL HOLDERS
and WESSONMETAL SOLID CARBIDE INSERTS

ON LeBLOND AND WICKES LATHES

NOW RUNNING AT ONE OF THE LARGEST AUTOMOTIVE COMPANIES

Wessonmetal—the cemented carbide giving users phenomenal performance throughout industry—turns to new successes on this difficult crankshaft turning job.



Plan view shows position of front and rear tools only.

HERE'S OUTSTANDING PERFORMANCE!

AN AVERAGE OF 9000 PIECES PER INSERT BEFORE SHARPENING

OLD METHOD	
Pieces	11 per hour
Cycle time	1 min. 55 seconds
Cranks per tool change (average)	1.7 pieces

NEW WESSON METHOD	
Pieces	48 pieces per hour
Cycle time	40 seconds
Cranks per tool change (average)	1500 pieces

WESSONMETAL

WESSON METAL CORPORATION
LEXINGTON 34, KENTUCKY

WESSON COMPANY
1220 WOODWARD HEIGHTS BLVD • FERNDALE (DETROIT 20) MICH

WRITE FOR *Complete Story* with DRAWINGS

International Limits Standardization

A world-wide standard system of tolerances and allowances between cylindrical parts applicable in the mechanical and other industries will be discussed by experts from eight countries, meeting in New York, June 16-19.

The meetings will be held at Columbia University in conjunction with the second triennial General Assembly of the 33 nation International Organization for Standardization (ISO), with the American Standards Organization, the U.S. member of ISO, acting as host.

General Jean Pierre Nicolau heads the French delegation, and will preside over the meetings. Other national standards bodies participating in the subcommittee work are those of Belgium, Netherlands, Poland, United Kingdom, Sweden, Switzerland, and Czechoslovakia. The United States is not represented in the work of the subcommittee, but members of the American Standards Association Sectional Committee B4, Limits and Fits, sponsored by the American Society of Mechanical Engineers, may attend as observers.

According to the draft agenda of the subcommittee, the delegates will discuss tolerances on tapers, tolerances on form, dial gages, and selective fit. They will also take up revision of eight points of the pre-war system of limits and fits.

Last year the 16 participating nations of the ISO Technical Committee on Limits and Fits formally reapproved an International Recommendation for the Reference Temperature of Industrial Gages and Measuring Devices. Previously there had been indecision and variation on the temperatures at which gages for metal fits were to be used to obtain measurement, without allowance for expansion or contraction. The temperature has now been internationally standardized at 68° F (20° C). This ISO recommendation had been an American Standard since 1925.

Seventy-six ISO technical committees are now working on standardization projects in such varied fields as plastics, iron and steel, screw threads, agricultural machines, textiles and textile machinery, gears, and transfusion equipment for medical use. Thirteen of these committees will meet during the two-week plenary session of ISO in New York in June.

with "DETROIT" you save mounting costs, increase production runs

First: "Detroit" craftsmen, working with finest precision equipment, take pride in the superior quality of every "Detroit" Die Set. *Second:* Every set is fully assembled and inspected at the factory. Here are complete inspection facilities and testing skill that mean each "Detroit" Die Set is right before it is shipped.

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DETROIT DIE SET CORPORATION
2895 W. GRAND BLVD. • DETROIT 2, MICH.

. . . Cost Controls, from page 72

A Measure of Efficiency

These budget standards are not a percent budgetary control system based on prospective sales of the entire enterprise, but measure the efficiency of each department against a daily budget goal, i.e., measuring in percentage of gain or loss what the department does, with what it has to work with, on what it is required to produce for that day and for the month to date.

The next step is to set up a procedure whereby the timekeeping and factory accounting departments can record the number of pieces of each type produced by each worker and the number of times his machine is set up for each type of product together with the actual time required to accomplish these tasks.

What to Include

All labor, both direct and indirect, including repairs to products, breaking—in new help, inspection, floor checkers, supervision, machine delays, and general indirect labor such as materials handlers, truckers, etc., is budgeted and reported daily.

All other items of expense including maintenance of machinery, tools and equipment, perishable tools, oils, lubricants and grinding wheels, power and light, gas, water are also reported by factory accounting and usually appear on foreman reports weekly or semi-weekly.

From the above information together with a complete table of predetermined budget standards, the timekeeping department is shown how to put the figures together quickly and accurately. The object is to have the timekeeping department prepare and place in the hands of the foreman a complete daily report on the following day.

Carnegie-Illinois Report

Back in the thirties, when the writer was developing this program for The Carnegie-Illnois Steel Corp., there was a mistaken notion that a weekly report would produce as efficient an operating control as a daily report. The reports were, therefor, started on a weekly basis. Shortly thereafter the General Superintendent decided to try the reports on a daily basis. The results were surprising. With very little more clerical computation and effort, the control of operating costs proved far more effective. It has been found repeatedly that it requires approximately the same number of clerks to compile daily reports for the Sheppard Plan as for any **reasonably accurate** standard or job cost systems, with the added advantage of the Sheppard Plan's tight operating cost control.

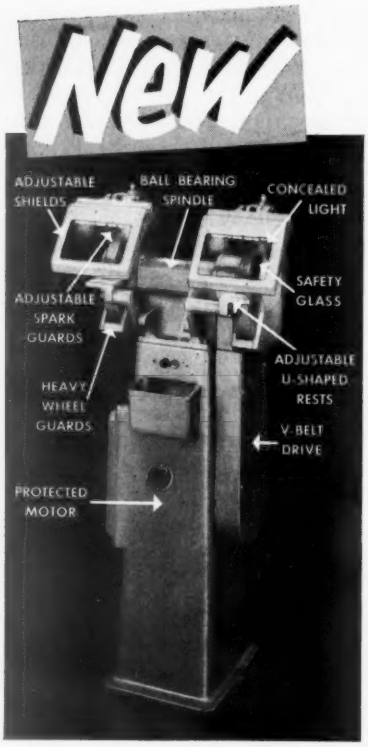
Productivity Gain or Loss

This daily report shows the foreman exactly how he did the day before in actual amount and percentage of gain or loss against the budget goal for every item of controllable cost for which he is responsible.

Up to this point the task of establishing a budget control system is a straight engineering

. . . Continued page 79

FRAY VERSATILITY
MOVES WORK FASTER!
Fray
NO. 10RH
UNIVERSAL RAM • TURRET TYPE • VERTICAL & HORIZONTAL
MILLING MACHINE
Speed up production by cutting job transfers with the versatile Fray 10-RH. This all-purpose milling machine performs an unequalled range of operations, cuts idle machine time and produces more work per man hour. It machines at any angle—vertical, horizontal or both. It mills, drills or bores at any angle. On any single piece of precision work requiring a variety of operations it is easier to reset the Fray than to transfer the work. For faster jobs, done better at less cost—investigate the easy to operate Fray 10-RH. A High Precision Tool.
FRAY "ALL-ANGLE" HEAD TYPE 4
For deep, heavy cuts. Permits working to extra close limits. Any angle up to compound 2-way. Request Bulletin 4.
Overall Height 7'
Write for Details and Specifications Bulletin 10
All-Angle
FRAY MACHINE TOOL CO.
515 WEST WINDSOR ROAD, GLENDALE 4, CALIFORNIA



SOUTH BEND
Pedestal GRINDER

A ruggedly built grinder that will give long, dependable service under hard use. Ideal for rough or precision grinding. The motor is enclosed in the pedestal and drives through a V-belt. This removes the weight of the grinding wheels from the motor bearings and practically eliminates vibration. Moreover, it isolates the motor from abrasive dust and provides greater work clearance. Send for catalog.

SPECIFICATIONS

Wheel Size: 8" dia. (½ h.p. motor), 10" dia. (¾ h.p. motor).

Spindle: Approximate speed 2450 r.p.m. Sealed ball bearings.

Motor: Standard 2875 r.p.m. 50 cycle or 3450 r.p.m. 60 cycle. Also D. C.

Over-all Dimensions: 49½" high, 18" wide, 20½" deep (10" Grinder ½" wider).

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

South Bend MACHINE TOOLS

Selection of Diamond Wheel Dressers

When selecting a diamond dresser for maintenance of grinding wheels, many shop men and purchasing agents are prone to decide on a single large diamond type . . possibly because it looks big and rugged. It's not a bad choice, not at all. There is some point, though, to considering the following factors in favor of the dresser type that embodies a number of small diamonds scattered in a matrix of hard, tough cemented carbide.

One large diamond is costly, especially this year when the industrial diamond supply is in such a critical balance. Many small diamonds, collectively, offer initial savings often as great as 40% of the cost of an average large diamond such as is commonly used in wheel dressers.

One large diamond offers but one cutting point. Any damage to, or wear of, this point or loss of the diamond ends the useful life of the dresser. In the impregnated carbide type of dresser, many small diamonds are hidden below those visible on the surface. Imbedded in the cemented carbide, these diamonds offer continuous and/or successive service. Whereas one large diamond must be handled with considerable care, abuse of the diamond-impregnated carbide dresser has very limited effects. When the cutting points on the surface diamonds have dulled, work pressure tends to tear them from the matrix. Diamonds below the surface are then readily exposed by an occasional two-minute reconditioning.

As the dresser is applied to the wheel, the distribution of pressure over a number of diamonds results in each one being used to a greater depth than the one large diamond before being knocked out. Economical use of a conventional dresser having a single large diamond requires frequent remounting of the diamond. And, actual loss of the single diamond is a frequent occurrence, necessitating an inventory of replacement diamonds. The impregnated type eliminates all troublesome remounting and in general permits a low inventory of dressers, and no inventory of diamonds.

Another point in favor of the impregnated type is due to the better distribution of stresses in the wheel effected by the larger contact area. When trueing wheels, this usually permits heavier infeeds, in order of .005" to .010".

In the past some people have been critical of the impregnated type dresser because of difficulties encountered in their manufacture relative to a uniform dispersion of diamonds through the cemented carbide matrix. Such uniformity is difficult to achieve; however, accumulative experience with this type dresser shows that the present degree of uniformity is sufficient for all practical purposes.

COMING NEXT MONTH
TOOLING and PRODUCTION's
4th Annual CARBIDES Feature Issue
Carbide Tooling In a Tank Plant
Carbides in Automatic Dies ★ CO_2 As a Coolant
Cemented Carbides . . . Development and Application
Power Requirements for Carbide Tooled Lathes
V-8 Crankshaft Tooling With Carbide Inserts
WATCH FOR IT! ★ DON'T MISS IT!

YESTERDAY'S PIONEER · · · TODAY'S LEADER

WELDON

Stub Length Double-End End Mills

Stock Items

This line of small size end mills, in both double-end and single-end, with flutes shorter than regular, provides the following advantages:

GREATER STRENGTH
LONGER TOOL LIFE
FAR LESS BREAKAGE
FASTER FEEDS

Furnished in 2- and 4-flute styles

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you

THE WELDON TOOL COMPANY
3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

PRODUCTION UP
COSTS DOWN
WITH *Commander*
PRODUCTION TOOLS

MODEL 900

Adjustable **MULTI-DRILL**

- Adjustable To Any Hole Pattern
- Drill 2 to 8 Holes at 1 Stroke
- Fits Any Drill Press

Increase production up to 800%—save time, cut costs. Mounted without alterations or special tools. 9" drilling area; centers to ½". Extension Spindles available to increase area to 22½". Special adaptations available.

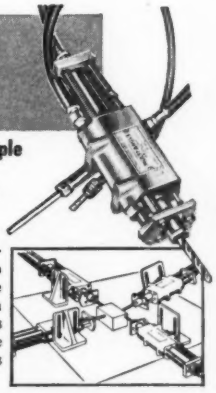
"the tapper that thinks for its operator"

Commander **TAPPER**

- Wider Range . . . 1 Tapper Handles #0 to ¾" Taps
- Automatic Tap Protection
- Furnished to Fit Any Drill Press

Adjustable full range torque control instantly stops any tap when it's dull, loaded, strikes a hard spot, or bottoms in blind hole tapping. Assures maximum production, cuts rejects, even with inexperienced operators.

MULTI-ANGLE DRILL UNIT



- Quick, easy set-ups for Multiple Drilling of angle holes
- Complete Drilling Unit—Full 4" Stroke

MULTI-ANGLE Drill Units provide unlimited freedom of set-up for long or short run multiple hole drilling jobs. May be mounted on fixtures, jigs or bolted to drill press table. Save time, cut costs on angle drilling. Used with any drill press or suitable power source.

Write FOR CATALOG #851
and the name of your nearby Commander Distributor

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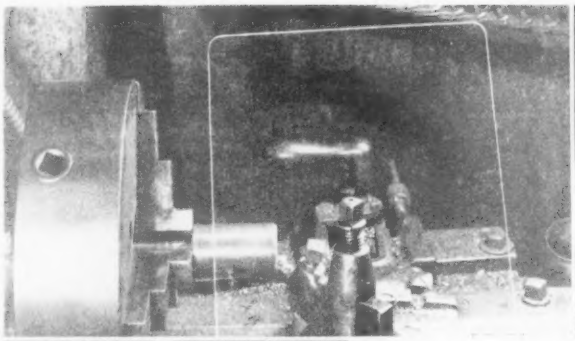

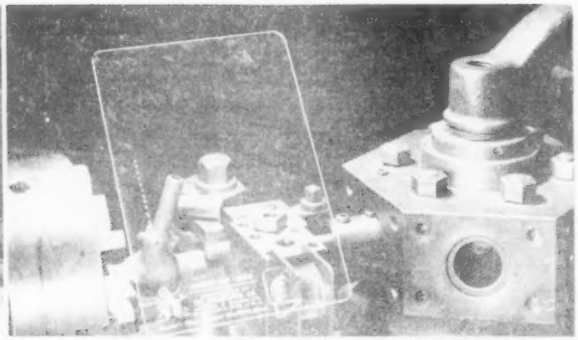

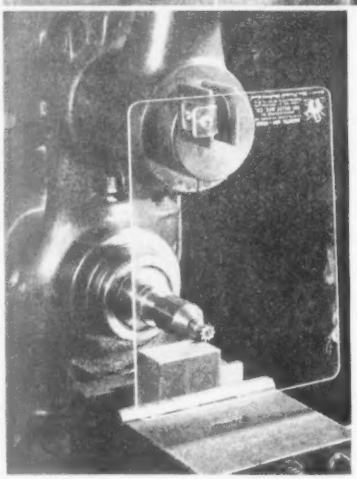

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Machinery Guarding

$ave Time

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Just magnetically *Grip* a Magnetic Grip-Shield to any machine, any position.

"It's a Dilley"

Order Now or write to

THE DILLEY MFG. CO.

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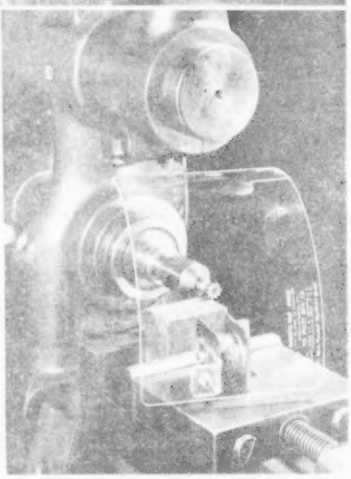

WHY tie up EXPENSIVE MACHINES and SKILLED MACHINISTS? WHEN

- UNSKILLED Operators can do
- close-precision work on quantity
- runs of small parts with the
- **BARKER Bench Type MILLER**

EASY ECONOMICAL SET-UP

EXCLUSIVE 3-WAY TRAVEL

TOOL ROOM MODEL AVAILABLE WITH MICROMETER FEED SCREWS

PRODUCTION MODEL

Smart "operators" in the metal-working field are using the BARKER "MILLER," a small precision production machine to handle many of their large volume runs on small parts. You can afford to set up several "Barkers" if necessary and leave them set up for successive operations on one particular part. Large, expensive machines left set up and idle can cut your profits.

A "Barker" will economically handle a complete range of milling, profiling, drilling, key-seating, end milling, slotting, turning, facing, boring and recessing lathe operations.

One or more "Barkers" will earn dividends in your plant. Write for full particulars.

BARKER ENGINEERING COMPANY

500 Green Road Cleveland 21, Ohio

DEALERS write for our PROPOSAL

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

. . . Cost Controls, from page 75

job of setting budget standards and developing budget reports. Making these budget reports pay off in cost cutting and production economies is where skilled judgement and operating experience count in utilizing information to eliminate the causes of high costs and wasteful practices.

In general, it is this writer's experience that when a skilled workman is given the right materials, tools, and instructions, and is convinced that his task is fair, he will do a reasonably satisfactory job of turning out his quota of pieces. Our program, therefore, is not necessarily aimed at the worker but is aimed at the planning and execution of the foreman's job.

Daily Planning

It is our objective to have the foreman plan each man's day; with materials available, and with the tools and machines ready for doing the work, together with the blue prints, operation sheets and other instructions necessary for the worker to begin his work. If, for example, on the daily report the performance of the direct work approaches 85 or 90% of the budget standard while the overall performance based on clock time versus budget time is in the vicinity of 65 to 70%, the difference between these two figures indicates foreman failure in providing the necessities to start each job promptly and to keep it running. If the foreman does his job as it should be done, the gap between overall performance and worker performance will be reduced to zero with the result of a vast improvement in both worker and overall performance.

Daily Warnings

The daily budget reports quickly flag for the foreman the wasteful practices of waiting for materials, waiting for an order, waiting for the machine to be set up or repaired, waiting for tools to be sharpened, waiting for the proper jig, and all similar delay time.

Foreman Interest

One of the reasons why these reports are extremely effective in every company where they have been installed is the intense foreman interest in the reports. Good foremen usually have a keen desire for the information the reports provide and are vitally interested in knowing exactly how they are doing. The foreman also knows that his superiors, all the way up to the top of the organization, will get summary figures showing his department battle to attain better performance against the budget standards.

Continental Can Company Experiences

I remember the first installation of our system in one depart-

. . . Continued page 123

For . . . TAPS
STEP CUTTERS
BORING TOOLS
PROFILE MILLS
CENTER DRILLS
ETC.
Inter-changeable cams and index plates for 1 to 14 flutes.
Inter-changeable collets up to 1.125" D.
Preloaded ball bearing spindle.
Easy-to-read settings. Easy to set up.
Base swivels for angular grinding.
Mounts on most grinder tables.
What a relief!
More Cuts Per Grind
Better — Freer Cutting
Reduce perishable tool costs with this preferred grind on your straight and spiral flute production cutters — Easy and fast as ordinary angular relief grinding.
D·S GRINDER DIVISION
ROYAL OAK TOOL & MACHINE CO.
621 E. Fourth St., Royal Oak, Mich.
D·S
RADIAL
RELIEF
GRINDER

. . . Hardness Testing, from page 66

the first rebound, and to take two or three more tests. The top of the hammer is observed against the graduated scale on the bounce.

Usually, several tests are taken. The average of these is considered the correct hardness of the specimen. However, the hammer should not be dropped more than once in the same spot, because its impact cold-works that spot sufficiently to make it harder, thereby boosting the reading on subsequent tests. Indentations produced by this instrument are always so tiny that they will not disfigure a finished surface. A special hammer may be obtained for use on soft materials if desired.

Sutiable For Thin Materials

Very thin materials may be tested with an instrument of this kind. On hard steel, thickness may be as low as .006", but for softer materials, thickness must be greater. Explicit instructions in this respect may always be obtained from the manufacturer. Surfaces tested must be flat, smooth, and free from oil or other materials. Spots may be buffed on specimens prior to testing if desired. The barrel through which the hammer falls must be in true vertical position. Otherwise, the hammer will rub to some degree while falling. Thus a portion of its energy will be lost, affecting verity of the test.

Because only very tiny impressions are left by a diamond hammer on this type of instrument, it has become very popular among manufacturers of steel and chilled iron rolls. Because of its popularity in this respect, a special roll-testing stand has been devised for attachment to the base of the unit. When equipped with a roll-testing stand the instrument is employed as a portable unit. When set down on a roll, the instrument barrel is held truly normal to the roll axis, also in line with a roll diameter.

Because many were unwilling to depend on the human element involved when an operator was called on to read the rebound of an instrument of this type against a graduated scale, it has been made available in a recording model. In order to do this, a highly ingenious mechanism was developed which locks and records the height of the hammer rebound by means of a ball and hollow cone clutch. The recording type of Scleroscope is provided with a knob instead of a rubber bulb for manipulating the hammer.

Unit Has Recording Dial

This instrument has all the

NO. OO HAMILTON PRECISION SMALL GEAR HOBBER

less THAN .0001" COMPOSITE error!

Spur gear: brass: 48 diametral pitch: 50 teeth: 20° pressure angle: less than .0001" composite error: generated on Hamilton No. 00 Precision Gear Hobber.

DEMANDS for mechanical accuracy become more and more insistent as new and improved designs reach production. And machine tools, purchased without consideration for future accuracy requirements, become obsolete before they are depreciated.

Protect your investment in gear generating equipment. Buy the one small gear hobber which is precise enough to meet future requirements, and rigid enough to hold its precision. Buy Hamilton!

←ACTUAL TEST (see illustration at left) made before secondary operation. Heavy lines equal .001"—light lines equal .0002". Gear made .004" undersize to allow for secondary operation.

THE Hamilton TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

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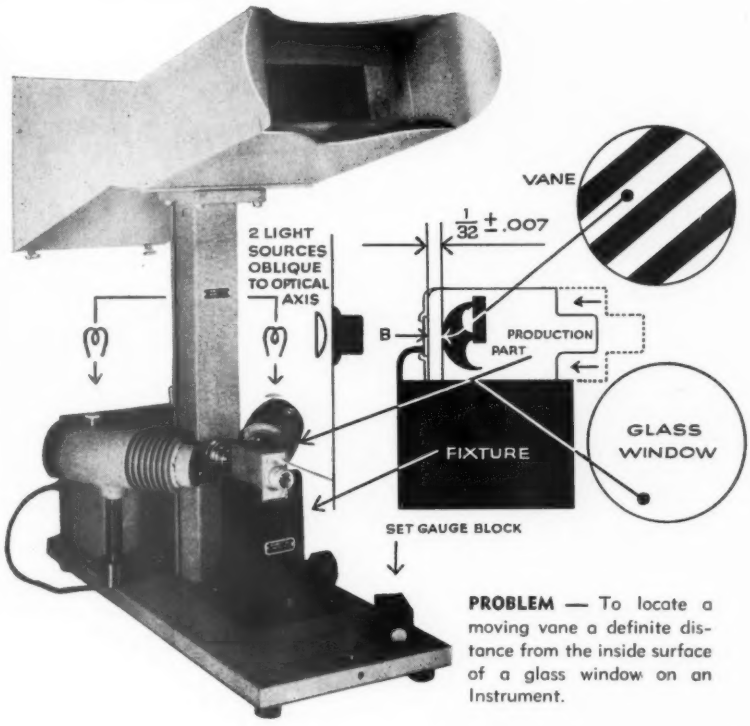
versatility of the direct-reading type, and incorporates a dial at the top. The dial hand remains in fixed position after a test is made, until the knob is again turned for another test. During actual turning of the knob, the indicator hand returns to zero, but never remains there. Its resting place is always at the dial number of the last hardness test made. A V-block is provided with the instrument for testing rounds or cylindrical pieces. Where it is desired to test balls, a circular V-block is provided, which fits on the anvil of the unit.

Instruments of this type are suitable for testing case-hardened parts, provided depth of the case hardening is sufficient. If the core is 30 hard or over, the depth of .01" is necessary to insure a faithful test. If the core is less hard, a case-hardening depth of 1/64" is necessary. Depth of the hardened case can always be determined by grinding a small nick and testing at the bottom of it until the soft core is reached.

A check can always be made on a Scleroscope to determine that it is still in truth. Master blocks of both hard and soft steel may be employed for a check. If any wear occurs on the diamond point of the hammer, or anything should happen to the instrument to impair its accuracy, these master blocks will always inform one to what extent readings are affected, because the master blocks are marked with a known hardness. Usually, when testing such an instrument on blocks of this type, it is required to show an accuracy of at least 95%. There are no adjustments that can be made on the instrument to regulate hardness readings. Assuming an instrument is in good condition, readings can be altered only by failure of the diamond point on the hammer. Should this occur, the instrument may be restored to its proper condition by inserting a new hammer.

One very light-weight and low-cost instrument operating on the Sclerometer principle of elastic rebound weighs only a half-pound, and can be carried in the pocket. Consequently, it is ready for use anywhere on the job, though it is very sturdily built. An accurately-machined hammer, tipped with non-elastic Carboloy, and of known weight, is allowed to drop through a measured distance and to rebound. As it rebounds, it is held at the top of its bounce by an ingenious clutch of magnetically-actuated ball-check type.

PROJECTION SOLVED THIS PROBLEM



PROBLEM — To locate a moving vane a definite distance from the inside surface of a glass window on an Instrument.

SOLUTION—The fixture is first positioned a definite distance from lens system by means of focusing on a Set-Gage Block. Then by placing production piece in fixture the internal part of instrument can be moved into position until it is in clear focus on the screen. By using an oblique lighting attachment an intense beam of light reflects the image of the vane behind the window on to the screen in front-surface projection. The method allows the moving vane to be set within Plus or Minus .007 to the inside of window "B".

OPERATOR TIME CYCLE—
120 per hour or more depending on skill of operator.

EQUIPMENT NEEDED—
Stocker & Yale 66 Horizontal Contour Projector—Short focal distance objective lens—Oblique Lighting attachment.

COST—
Less than $1000 including engineering.

Stocker & Yale
INCORPORATED

MARBLEHEAD, MASS.

Reading Link On Hammer

The instrument is very simple to operate. A line is marked on the hammer. A graduated hardness scale of vertical type is provided on the face of the instrument, so a reading may be taken at the line marked on the hammer, after the test has been made. When desired, a reading from this tester may be quickly and easily converted to equivalent Rockwell B or C Brinell scales, using a conversion table which is supplied with the tester. The fact that these instruments may be bought at very low cost, allows them to be used by various men other than a very few designated inspectors.

What is undoubtedly the smallest hardness tester operating on the rebound principle comes in a nickel container, the size of which is only 7¼" long by ⅞" round. A companion model comes in a nickel container the size of which is 6½" long by ¾" round, and its weight is about 5¼ ounces. Either or both of these instruments may readily be carried in the pocket, enabling engineers, metallurgists, foremen, laboratory workers and others to take hardness readings at any time and at any point.

Operation of these little instruments is very simple. One simply places them vertically on top of the object to be tested, lifts a rebound bar above the locking device, and releases the catch. The rebounding bar has a hardened steel ball point, which strikes the test object and rebounds. Through a device arranged in the head of the instrument, the rebounding bar is caught in a mathematically-exact position.

A hardness scale is provided on the front of the instrument. Reading of hardness degree is by means of a marker on the rebound bar. If desired, one can obtain a conversion table to Shore Scleroscope, to Rockwell B or C, or to Brinell. Objects weighing four pounds or more can be tested directly without difficulty. Where smaller objects are to be tested, such as small machine parts, etc., it is necessary to place them on a steel block or anvil.

Pendulum Type Hardness Tester

Another very interesting instrument operating on the rebound principle is of pendulum type. The front face of this instrument shows a curved scale, graduated in degrees of arc, upon which lies an indicating wire. The position of this wire discloses the hardness value, because it is positioned by maximum rebound of the pendulum-type hammer. A small lever is

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located in an upper corner of the instrument, which is employed to re-locate the indicator at zero, after the pendulum is returned to its catch.

The back side of the instrument is provided with a curved exterior scale, with a zero point on the sliding carriage. This carriage holds the pendulum catch. It can be set at any scale position to vary the testing load. A knurled button is provided on the carriage, which releases and locks the desired position of the unit. In making the test, the instrument is simply held against the piece to be tested, and the pendulum hammer is released by means of a pin on the rear of the device.

Upon striking the piece being tested, the pendulum hammer rebounds, carrying the pointer along with it to a location on the scale representing the highest limit of the rebound. Thus, an indication of hardness of the material is given. Scleroscope, Brinell or Rockwell hardness numbers may be obtained if desired, by means of a conversion table created from some certain material, and usable for that one material only. No appreciable amount of time is required to take a reading, and numerous readings may be taken in rapid sequence.

An interesting and important accessory is available for use in connection with this instrument where required. This is a small attachment which allows an operator to make accurate tests of every shape and hardness of material. This attachment allows anything from wire to heavy castings to be accurately tested. Certain difficulties are connected with accurate testing of small, light, hollow, or wedge-shaped parts, or machine parts, because they yield or slip from the pendulum impact. The attachment mentioned automatically presses the exact spot required against the face of an anvil, and thereby assures firm support.

Dynamic Vs. Static Testing

All the foregoing testers, using the principle of elastic rebound, are sometimes referred to as dynamic testers, over against static testing devices, which operate on the principle of applying given loads to produce indentations in the specimens being tested, after which the indentations are measured in order to determine hardness.

The Brinell test is a time-honored static method much employed. It has to do with pressing a hardened steel ball into a specimen being tested. Either the diameter or the depth of

THESE 3 EXCLUSIVE FEATURES MAKE SUPERIOR Precision All-Steel DIE SETS SAFE and EASY to HANDLE
1. Safety Flange
2. Lock Jaw Lifting Device
3. E-Z Lift Sling Chain

1 SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. *There is no extra charge for this valuable safety feature.*

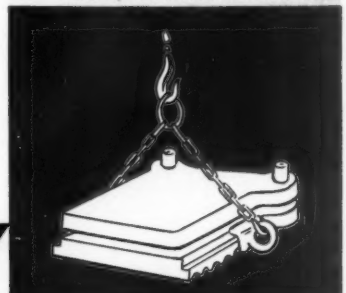
It's no longer necessary to take needless risks in handling die sets. Risks that might easily injure the hands of skilled die makers, ruin costly dies in process or completed, or even damage press equipment. Safety features of Superior die sets have eliminated all of these dangers and have speeded up the overall handling of sets from the bench to the press. Prove to yourself the merits of these safety features in both small and large die sets.

FREE CATALOG

Please state company name and your capacity when requesting this helpful data on die sets and die makers' supplies.

2 LOCK JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.



3 E-Z LIFT SLING CHAIN

is especially designed to fit the safety flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs. Nor is there danger of distorting stresses being set up in the die or set because of improper lifting.

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the resulting permanent impression in the metal may be measured. The Brinell hardness number is taken as the quotient of the applied load, divided by the area of the surface of the impression, which is assumed to be (though it is not actually) spherical. Thus, the Brinell test is a measure of resistance to indentation under static fixed load. It provides important information both in research and in production control.

On all types of metal, this test furnishes a very good index of such factors as machinability, uniformity of grade, temper after heat treatments, by the hardness of the metal. Various types of machines are available for making the Brinell test. They vary in reference to methods for applying the load to the ball, in reference to size, and in regard to methods employed for measuring the indentation. In order that the flattening effect of pressure on the ball may not be sufficient to permanently deform it, balls of tungsten carbide are often employed for testing harder steels.

While the Brinell test is a simple one, it is not found satisfactory for testing very thin pieces, because the usual indentation may approximate thickness of the piece to be tested. Neither is it adapted for testing case-hardened surfaces, because indentation depth may be greater than thickness of the case. Also, the soft core beneath may yield sufficiently that the result may not be depended upon.

Not Spherical Indentations Produced

Because the ball undergoes a certain amount of temporary deformation under load, also because there is some recovery of the test piece when load is removed, the indentation is not a true portion of a sphere. By the same token, indentations produced by different sizes of balls under different loads are not similar geometrically. Notwithstanding these facts, very close results may be obtained in reference to hardness readings.

Some Brinell hardness testers are adapted both for stationary and portable use. One such instrument, which puts a load of 3,000 kg. on a 10 mm ball ordinarily, (though other loads may also be applied as required) is equipped with a removable test head for testing larger parts. This test head can be operated in any position, even upside down. When out of the base, it may be used with any means of force application capable of withstanding the three-ton thrust of the ram on the ball.

Incidentally, this test head is

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HIGH SPEED SPECIAL RIGHT HAND TAPS

SIZE	THREAD	SIZE	THREAD	SIZE	THREAD
4	32-40-48-64	3/8	12-16-18-20-27-28-32-36-40-48	1-3/4	8-10-12-14-16-18-20-24
5	30-32-36-40-48	7/16	12-16-18-22-24-27-28-30-32-36-40	1-13/16	8-10-12-14-16-18-20
6	30-40-48-56-80	1/2	12-14-16-18-22-24-26-27-28-30-32-40	1-7/8	8-10-12-14-16-18-20-24
7	32-40	9/16	16-20-24-27-28-30-32-40-48	1-15/16	8-10-12-14-16-18-20-24-28
8	24-30-36-38-40-44-48	5/8	12-14-16-20-24-27-28-32-36-40	2	4-1/2 - 8-10-12-16-18-20
9	24-28-32-40	11/16	11-16-18-20-24-27-28-30-32	2-1/16	12-14
10	24-30-36-40-48-64	3/4	8-11-12-14-16-18-20-24-26-27-28-32	2-1/8	12-16-20
12	24-28-32-36	13/16	16-14-18-28-32	2-3/16	12-16
14	20-24-28	7/8	10-12-16-18-20-24-27-28-32	2-1/4	4-1/2 - 8-12-14-16-18
1/16	60-64	15/16	8-9-10-12-14-16-18-20-24-32	2-5/16	12-16
5/64	72	1	10-12-16-18-20-24-27-32-40	2-3/8	12-16-18
3/32	48	1-1/16	12-14-16-18-20-24	2-1/2	8-10-12
7/64	48-56	1-1/8	8-10-14-16-18-20-24-32	2-9/16	16
1/8	32-40	1-3/16	8-10-12-14-16-18-20-24	2-5/8	12-16-20
5/32	32-36-40	1-1/4	8-10-14-16-18-20-24-32	2-3/4	16
9/64	36-40	1-5/16	12-14-16-18-20-24-32	2-7/8	8-12-16
11/64	36	1-3/8	8-10-14-16-18-20-24	3	8-16
3/16	20-24-32	1-7/16	8-10-12-16-18-20-24	3-1/4	8-12-16
13/64	32	1-1/2	8-10-14-16-18-20-24-28	3-1/2	8-12-16
7/32	24-28-32	1-9/16	18-20-24	3-7/8	8
1/4	18-24-26-27-30-32-36-40	1-5/8	5-1/2-8-10-12-13-16-18-20-24	4	8-12
5/16	16-20-22-27-28-32-40	1-11/16	10-12-14-16-18-20-24		

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD	SIZE	THREAD	SIZE	THREAD
0	80	3/8	16-24-32	1-3/8	8-8-10-12-16-18-20-24
1	56-64-72	7/16	14-20-28	1-7/16	8-10-12-14-16-18-20
2	56-64	1/2	12-13-20-28	1-1/2	8-8-10-12-16-18-20
3	56	9/16	12-18-20-24	1-9/16	8-10-12-16-18-20
4	32-36-40-48	5/8	11-12-18-20-24	1-5/8	8-10-12-14-16-18-20
5	40-44	11/16	11-16-24	1-11/16	8-10-12-14-16-18-20
6	32-36-40	3/4	10-16-18-20	1-3/4	8-10-12-14-16-18-20
8	32-36-40	13/16	16	1-13/16	8-10-12-14-16-18-20
10	24-30-32-40	7/8	8-12-14-18-20	1-7/8	8-10-12-14-16-18-20
12	24-28-32	1	8-12-14-16-18-20	1-15/16	8-10-12-14-16-18-20
1/4	20-28-32	1-1/8	7-12	2	4-1/2 - 10-12
5/16	18-20-24-28-32	1-1/4	7-12-16-18		

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easily mounted on a large planer or boring mill, etc., for use over large areas, or where routine testing is more advantageously done by passing the parts under the test-head. Used as a bench machine, this unit makes a testing-stand of practically any available bench. It is impossible to put too much pressure on the ball, because there is a pressure-limiting valve, which does not allow the load on the ball to go over 3,000 kg. Incidentally, this instrument may be used for testing rails after they are installed in railroad tracks.

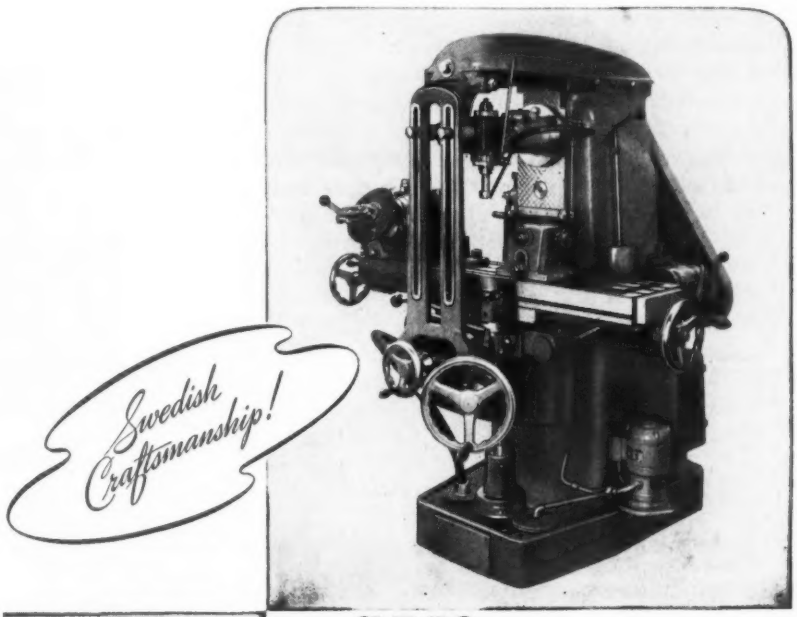
Most Brinell tests are made while using a 10 mm steel ball with a load of 3,000 kg. This has been found perfectly satisfactory for Brinell numbers ranging from 100 to 700. Due to deformation when testing harder materials, a tungsten carbide ball is often used for Brinell numbers above 600. However, a correction must be applied for the harder ball, since it will give a higher Brinell number than the usual steel ball. For Brinell numbers under 100, a 10 mm ball with a load of 500 kg is recommended. It should be remembered that where Brinell tests are being conducted continually on castings having sand on the surface, there is a certain amount of abrasive effect on the ball continually. Therefore, it is well to change the ball every now and then.

Dead Weight Principle Used

Some Brinell hardness testing machines use the principle of dead weight for applying the load, while others have the load applied hydraulically. Some of the machines are hand-operated; others are motor-operated. Some are meant for laboratory use, others for production use. Some who manufacture various types of Brinell hardness testers are in a position to furnish special fixtures as required, for testing unusual shapes.

The interval of time for which a Brinell load is applied is important, especially with reference to having it sufficiently long. In most standard Brinell tests, full load is applied for a minimum of 10 seconds when testing ferrous metals. A thirty-second interval is usually employed for softer metals, after which the load is released. However, some prefer to use time intervals much longer than these. An interesting aspect of some Brinell hardness testing machines is their inclusion of an interval timer, to definitely govern the length of time the load is held.

To be continued



Sajo Vertical Milling Attachment

The Sajo "Plain" Milling Machine

the SAJO "UNIVERSAL" MILLING MACHINE

exemplifies the expert workmanship that is traditional in Swedish machine tools. Like all SAJO Millers, this new Universal Milling Machine was designed and built to the highest standards of quality and practical utility.

Avoidance of exterior "luxury" features, slight in value but substantial in cost, and concentration on the vital factors of construction, enable the SAJO to deliver top performance at moderate cost.

SAJO Millers are available in Plain and Universal types, with longitudinal power table feed only, or with power feed in all directions. Screws and dials are in the U. S. inch system.

★ Standard Equipment includes: 3 HP motor and starter equipment, motor driven coolant system, adjustable table feed nut to allow climb-milling, 1" arbor, arbor support brace.

★ Extra Equipment: Universal Dividing Head, Vertical Milling Attachment, Slotting Attachment, Swivel Base Vise, Rotary Table.

CONDENSED SPECIFICATIONS

Table Size	41⅛" x 9⅛"
Longitudinal travel: Plain Miller	24½"
Universal Miller	27½"
Transverse travel	8¼"
Vertical travel	19"
12 spindle speeds	36-1540 RPM
Table feeds	12
Taper in spindle	No. 40 NMT
Main motor	3 HP

Precision anti-friction bearings on spindle and gear shafts
One-piece column and base
Net weight—2200 lbs.

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DEALERS IN PRINCIPAL CITIES

. . . Plastic Models, from page 68

up and handled, disassembled, and put back together again, and given a close scrutiny by every member of the consulting team, it makes the job much easier for all concerned.

Changes suggested by the various members of the team can be quickly incorporated in the plastic models. In some cases a revised model can be available for further discussion the same day, or at the worst within a matter of two or three days. Comparable steel models would take anywhere from three to six weeks. It is sometimes advantageous to construct new models incorporating the suggested changes, so that a record can be kept of the design in its various stages of development.

After these major design decisions have been made, the Engineering layouts and detail drawings are completed accordingly. At this stage of the game the full-size steel pilot models are started. It is quite apparent that many expensive changes which normally would have had to be made as the pilot models were built up, have now already been made at considerably less cost in the plastic model stage.

When the hammer forms, or Kirksite or plastic dies for pilot model use have been completed, full-size duplicates of the production parts are frequently made in plastic. These full-size duplicates are used for checking the flow of metal and other die conditions, material handling problems, and to aid the fixture designer in better visualizing the fixture he is to design. In many cases the plastic part is used for preliminary setting of the fixture.

Used in Engineering of All Production

The application of this medium to products other than those in the automotive field, such as aircraft, appliance, toys, farm equipment, special machinery, and others, has been recognized and is being used to full advantage.

Free-hand sketches and cardboard models have played their parts, and in many cases will continue to be of considerable service, but the opening up of the plastic model field has proven to be a greater boon to the engineer than any other previous design technique.

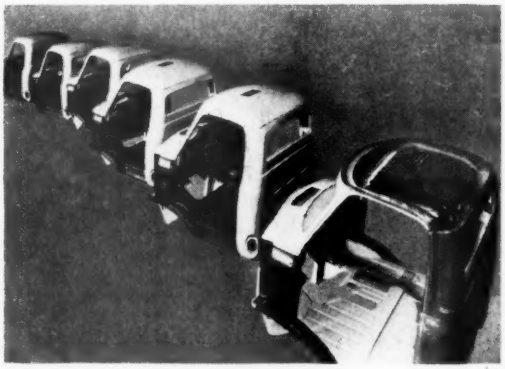

Fig. 7. Duplicate Models

. . . Die Quench, from page 57

valve arrangement actuates the pumping system as the upper die member approaches or reaches the bottom of the ram stroke.

The percent of stretch introduced in the metal by form-die quenching is proportional to the coefficient of thermal expansion of the alloy at the processing (heat-treat) temperature. The elevated temperature causes a uniform expansion of the metal in all directions. Forming the heated metal under high pressure stretches it in fine uniform increments. This maximum deformation is held constant by allowing the upper die member to dwell at the lowest point sufficiently for the quenching action to be complete. Thus, there is no shrinkage, nor spring-back, nor residual stresses.

Complete cycle programming is critical in order to achieve exact dimensions as well as the necessary physical properties in the formed workpiece without the necessity of corrective operations.

Several die materials have been used successfully. Principally, these have been copper-faced Kirksite which offers **high** thermal conductivity and steel-faced Meehanite which offers **low** thermal conductivity.

THE KOCH TEST INDICATOR

IS THE ONLY TOOL MAKERS INDICATOR ON THE MARKET WITH TWO WORKING ENDS, FOR PRECISION WORK, ONE END TO TEST OUTSIDE SURFACES, THE OTHER INSIDE.

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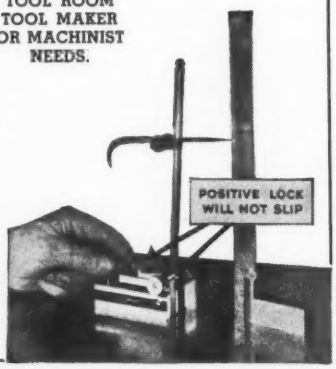

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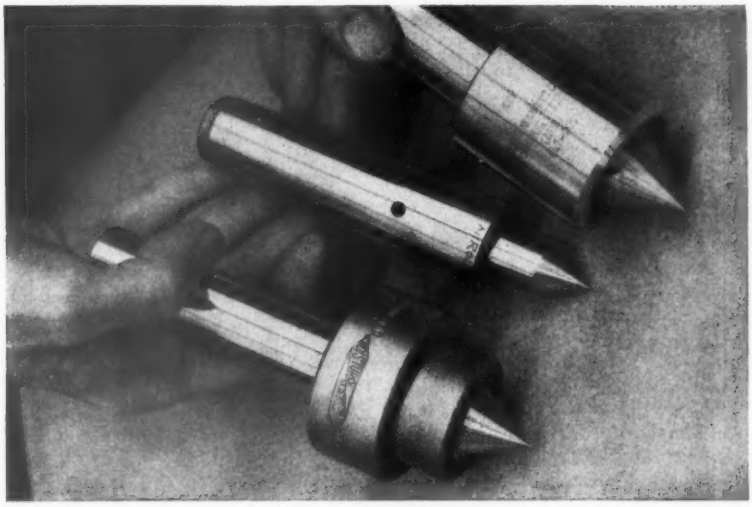

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ANTI-FRICTION BEARING DISTRIBUTORS' ASSOCIATION — MEMBER AFBDA

Emergency Repair Orders Speeded By Airtube System

Speedy handling of orders, particularly emergency orders for repair parts, was a problem of great concern to the Deming Company of Salem, Ohio, manufacturers of pumps and water systems.

For over 70 years Deming pumps and water systems have been installed on farms and in industrial plants. In either case, when the pump or water system doesn't function, serious complications can result. Installation of a Lamson Airtube system between the order department in the main office and the production department across the street, solved many of the problems of speeding up orders. This makes possible getting the pump back in operation without undue loss.

This Airtube system runs from the main office building, under the street, beneath the foundry, to the production office where there is a central desk. The production office is connected with the engineering department and two of the sub-assembly departments by separate lines. The system is used to carry orders, invoices, blueprints and even small parts between all points. It is interesting to note that the success obtained through use of the first tube resulted in the installation of additional tubes to other departments.

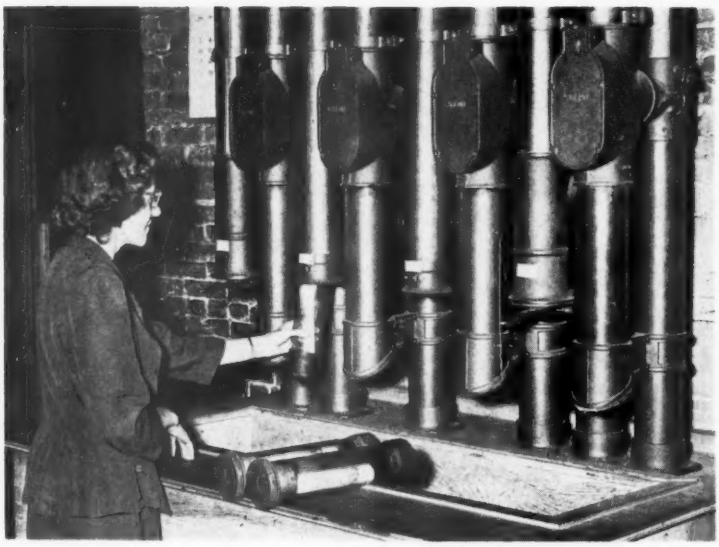

Fig. 1. The central desk in the production office connects with all other stations in the system.

Orders were formerly carried by messenger. The messenger made his round of the various departments. If orders were ready, he picked them up and carried them to the production office. He could only make one round per hour. As a result, there could be considerable delay in transmittal.

Orders for repair and renewal parts come in by letter, wire and telephone. As a result, the fastest possible handling is required. Now with the Airtube installation, the order is written up soon after it is received. It is then dispatched to the production office where it arrives some 200 yards away in approximately 13 seconds. This has resulted in the plant's being able to ship some urgent repair orders on the same day as received. As a result, good relations with customers have been maintained. Emergency repair orders are specially marked and handled. The present systems also means a reduced sorting problem since smaller batches of orders are transmitted at one time to the production office. The fact that the Airtubes connect the production office with the two departments which handle most emergency parts and repairs means that an order can receive almost immediate attention. During processing, orders may use the system more than once, since they may be transmitted from the production office to the various assembly departments or to the engineering department.

After completion, orders are returned to the main office by tube to be turned over to the accounting department for billing.

The system also has greatly simplified the use of blueprints throughout the pant. A request can be sent to the engineering department through the tube. A print is produced and immediately returned the same way.

The installation has resulted in safer, quicker and surer delivery of all papers and small items.

Fig. 2. This Airtube station is located in the order department in the main office building.

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- NORMALIZING to 22 ft.
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The GEO. H. PORTER STEEL TREATING Co.
Since 1919
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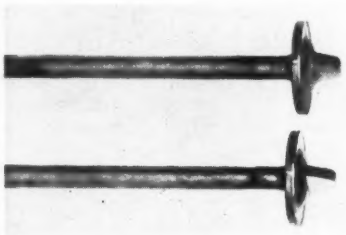
Forgings Sized by Straddle Broaching

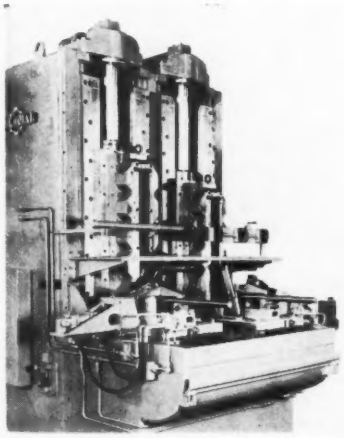
One of the big problems in machining steel forgings is the amount of stock left for finish, which increases as the dies wear.

This problem has been avoided in the operation for straddle broaching a tang on the end of an SAE 8653 truck axle, shaft steel forging, by specifying a dual



rough and finish broaching setup. This method allows considerable size variation in the forging but leaves a uniform amount of stock for the finish broaching operation. The machine on which these operations are performed is a 26-ton 66-in. stroke dual ram broaching machine.

The shafts are located radially in the fixtures by retractable fingers that move out of place when the table shuttles into broaching position after the parts have been hydraulically clamped. The parts are loaded into the fixture manually. After a pass of the broach, a finished broached part is removed from the right hand fixture, a rough broached part lifted from the left hand fixture is then loaded in the right hand fixture and a rough forging is loaded in the left hand fixture. Thus a finished part is produced with each pass of the broach.



Photos courtesy Colonial Broach Co.

Baumbach Socket Head Cap Screws
Ground Machined Steel Plates and Discs. We furnish plates and discs in any size or shape cut to your requirements in micknesses from ¼" to 6". We Blanchard Grind up to 84" diameter.
Baumbach Patented Self-Sizing Rite-Fit Dowel Pins.
Baumbach Socket Head Stripper Bolts
Baumbach Socket Head Set Screws
Safety Tongs for handling Die Sets or Plates.
"T" Handle Wrenches for assembling Demountable Leader Pins and Bushings to Die Shoes and Punch Holders.
Specially designed Baumbach Drop Forged Steel Die Shoe Clamps.
Patented Punch Jacks for use in separating Die Sets.

Baumbach Die Set Accessories Immediately Available From Stock FROM JERGENS

SAVE ON FREIGHT CHARGES—GAIN ON TIME! All Ohio Industry can now enjoy the superiority of Baumbach Die Sets and Baumbach Die Set Accessories with immediate shipment from stock plus substantial savings in freight.

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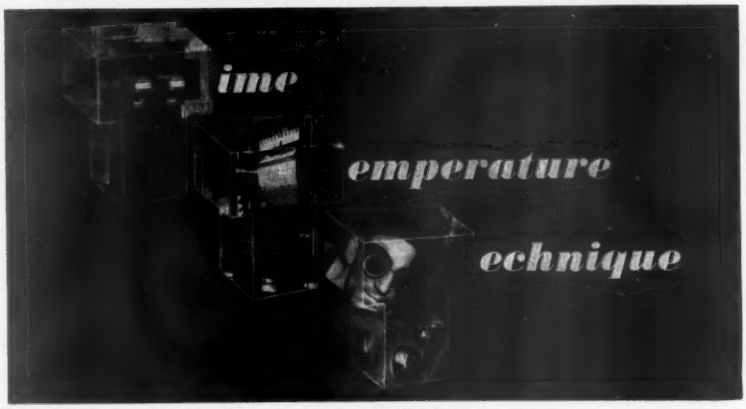

WHETHER it's the treating of your rough forgings, castings and bar stock, or your finish-machined parts—the 3 T's of Scientific Steel Treating are at work for you. From the unbiased, scientific recommendations of your Lakeside metallurgists; through the perfected, fully mechanized electronically-controlled processes to instrumented, precision testing; Science directs every step. No chance for guesswork, or human error. Only with the finest, modern facilities can you be assured of highest steel treating quality.

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Industrial News

Vanadium Corporation of America

Production of alloys has been started at the new $2,500,000 plant of Vanadium Corporation of America near Cambridge, Ohio, according to an announcement by William C. Keeley, president. The plant is located on a 120-acre site which is about 100 miles from the company's new $8,000,000 alloy producing plant at Graham, W. Va. The facilities include three low frequency induction furnaces previously operated at the company's leased Chester, Pa., plant which was returned to the United States Government for re-activation by the Air Corps.

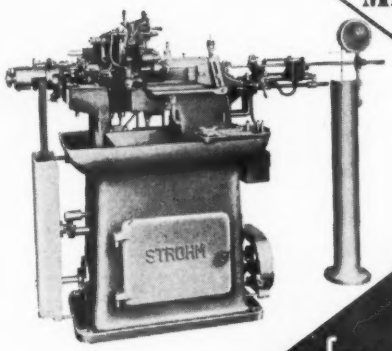
At the present time, activities at the Ohio plant are confined largely to the manufacture of aluminum alloys. An office building and a laboratory are under construction at the site. A pilot plant for experimental work in aluminum and alloy metal production is scheduled to be built, also. Ferro vanadium, grainal alloys, low carbon ferro titanium and other alloys will be produced when construction of the plant is completed next year. At that time, approximately 250 persons will be employed.

Manufacturers Industrial Supply Corp.

A group of tool and industrial supply manufacturers has announced the establishment of a new distributing and warehousing organization to be known as Manufacturers Industrial Supply Corporations. These corporations will be located in principal industrial centers and will serve as branch offices and warehouses for their manufacturing members. They will sell tools and industrial supplies, manufactured by their suppliers, only to established wholesale distributors. No sales will be made directly to users of such tools or supplies.

The main purpose of M.I.S. is to secure stabilized distribution of its suppliers' products in good times and bad, and to give suppliers control of that distribution. It will also serve tool and industrial supply distributors as a convenient factory branch or warehouse from which they can supply customers promptly on many out-of-stock items. Its slogan is "Service from the Shelf" for the Industrial Supply House.

SWISS-TYPE AUTOMATIC SCREW MACHINES



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extreme tolerances

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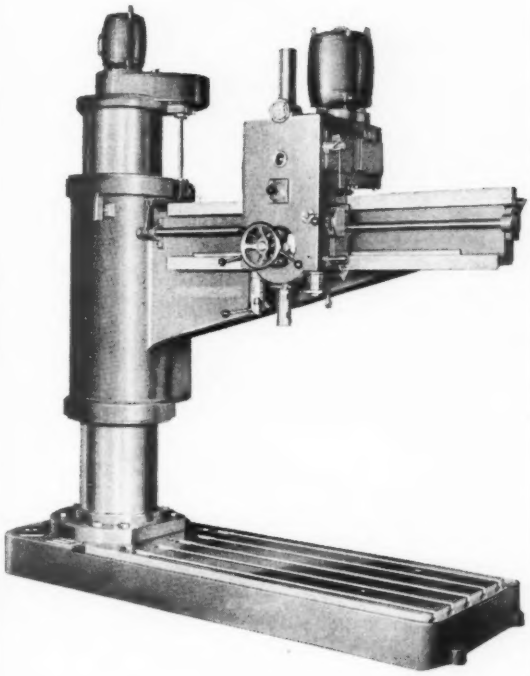
New MAXIM
HEAVY DUTY RADIAL DRILLS

Maxim Heavy Duty Radial Drills have spindle drive thru motor on drill head, spindle reverse for tapping.



Series "BR", Type	BR 32	BR 40	BR 50
Arm x Col. Dia.	3' x 11"	4' x 13"	5' x 15¾"
Capacity in steel	1¼"	1-9/16"	2"
Spindle Speeds, RPM	32 to 1400	32 to 1400	35 to 1400
Main drive motor, HP	4	5	6½

Series "L", Type	6812L	6817L	6817L3
Arm x Col. Dia.	4'3" x 15½"	5'10" x 17½"	9'1" x 17½"
Capacity in steel	2"	2½"	2½"
Spindle Speeds, RPM	32 to 2500	25 to 2000	25 to 2000
Main drive motor, HP	5	8	8

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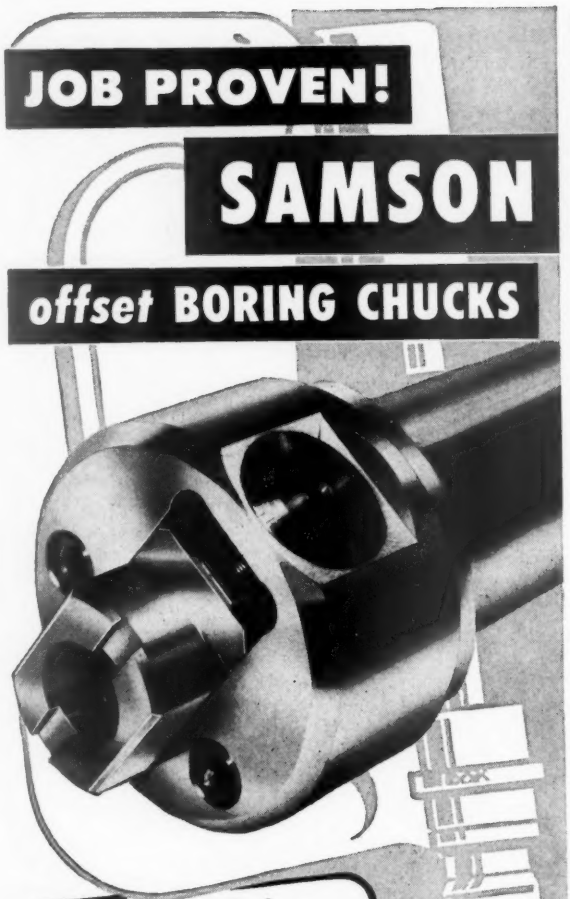

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• Designed for quick tool change; equipped with new, extra large dial for precision radial adjustment; machined to provide positive dead centering for rigid, high production milling and boring without removal of chuck; available with a complete selection of interchangeable accessories—these are features that make the Samson Offset Boring Chuck the logical first-choice of the field.

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Precision-made of both Carbon Vanadium and high carbon, high chrome steels. Available in a wide range of stock sizes from 1/32" to 1" point diameters in increments of 1/64" for immediate delivery. Decimal sizes to order for delivery within 48 hrs.

Button Dies
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Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

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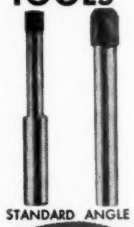
RAYMAC *Solid Carbide* GRINDING TOOLS

Raymac Solid Carbide Grinding Tools increase production and lower costs. They mill hardened metal accurately and do not wear fast or burn the metal.



STANDARD ANGLE

Write for Catalog No. 12

BUSHING TYPE

RAYMAC MANUFACTURING COMPANY INC.

3729 CASS AVENUE, DETROIT 1, MICH.

Air Pressure Economies*

Regarding the production economy relative to portable air tools, it is wise to study closely the effect of low pressure on cost of operation, particularly from the labor cost standpoint.

Low air pressure means simply operating the tools at pressure below that for which the tool was designed to give maximum performance. This low pressure may result from: (1) insufficient compressor capacity where the compressor is just too small to send desired air pressures to all points of use, (2) inadequate piping where the piping, or hose, to tools is too small or so poorly laid out as to result in excessive pressure drops, or (3) leakage.

Pneumatic tools are designed to operate at 90 pounds air pressure, which has been generally established as standard operating air pressure for maximum performance and maintenance.

If tools are operating at low pressure, there is no economy in air cost. At lower pressures, it takes longer to perform an operation. This longer operating period will use approximately the same amount of air at low pressure, as the amount of air that would have been required using the recommended 90 pounds pressure.

With air tools there are certain fixed costs. The initial investment for a large portable pneumatic grinder is about $210.00. This tool has an average life of about five years. Let us exaggerate and assume a 100 per cent maintenance cost over the five-year period of $210. The total cost of the tool is, therefore, $420. Working for five years, 50 work weeks in a year, and five days per work week, this total tool cost comes to about $0.30 per day.

A large 8-inch capacity pneumatic grinder is used normally about 30 per cent of the total time.

At this rate its air consumption comes to about 20.4 cubic feet per minute, or 1224 cubic feet of air per hour. Air costs depend entirely upon the efficiency of the air compressor. Estimates place today's costs at between $.035-$0.07 per 1000 cubic feet. Using the highest cost of $.07 per 1000 cubic feet at 90 pounds pressure, it would cost about $0.085 per hour, or about $0.68 per day, to operate this grinder. Smaller size pneumatic tools will use less air and cost as little as $0.05 per day.

The total fixed cost on the large grinder, therefore, comes to about $0.98 per day.

The only other cost which can be associated with the air tool is that of the worker using it.

Assuming a minimum wage of $1.65 per hour, the labor cost comes to about $13.20 per day.

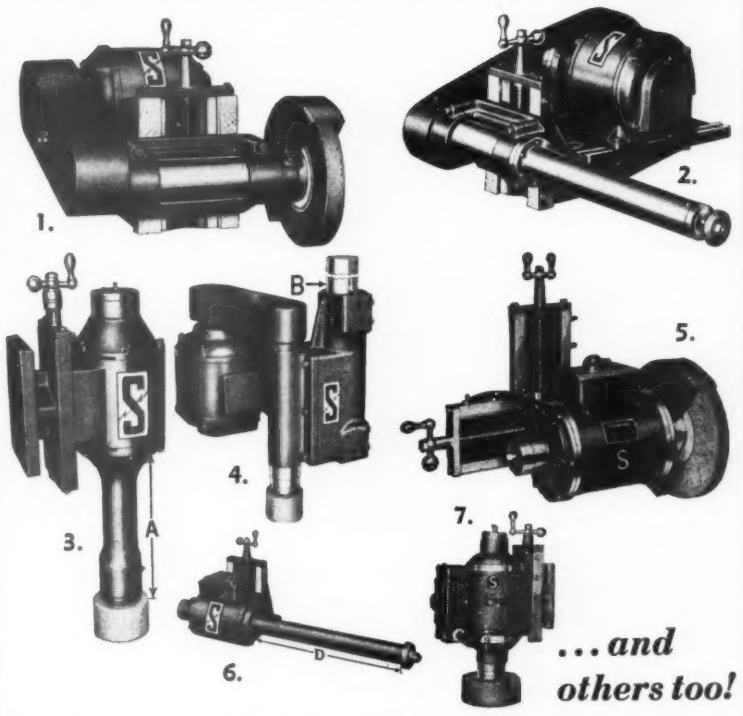
This may be a fixed cost from the standpoint of labor accounting, but from the standpoint of production and unit output this cost can vary considerably, particularly if the air tool is receiving low-pressure air.

A pneumatic tool loses power and efficiency in direct proportion to the reduction of air pressure. For example, a pneumatic tool that develops 1.03 horsepower at 90 pounds pressure will develop only 0.904 at 80, and 0.708 at 60. In other words, dropping the pressure from 90 to 80 pounds results in a 12 per cent decrease in power output, and, similarly, from 90 to 60 pounds results in a 31 per cent power drop.

The drop in horsepower causes a drop in the tool rpm and work ouput of the tool. This loss of from 12 to 31 per cent in labor output of the tool, although in actual operation as little as 30 per cent of the time, can amount to anywhere from $0.48 to more than $1.23 per day per tool. If quite a few tools are in operation, the loss can be substantial.

*From the Compressed Air and Gas Institute, Cleveland, Ohio.

MOTORIZED SPINDLES *all kinds*



...and others too!

1. Belt Driven Lathe Grinder ¼ H.P., to 20 H.P.
2. Belt Driven Internal Grinder. Grind up to 24" deep. ¼ to 3 H.P.
3. Vertical Spindle Grinder with up to 16" "A" dimension.
4. Vertical Spindle Grinder, belted motor drive, ½ to 5 H.P.
5. Angle Plate Grinder with horizontal and vertical feeds. ¼ to 10 H.P.
6. Internal Grinder, direct motor drive. Grind up to 30" deep. ½ to 5 H.P.
7. Vertical Spindle Grinder with or without feeds. ½ H.P. to 25 H.P.

Items 3, 4 and 7 for Planer or Boring Mill, etc.

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GOOD GRINDING

This latest Landis brochure has all data, amply illustrated, on comprehensive line of precision cylindrical grinders. Universal, plain, and single purpose high production types.

Circle No. E5.

84 RIVETT

This model small hole grinder gets great versatility from the ease with which it converts to external grinding. New catalog from Rivett Lathe & Grinder, Inc., has all features.

Circle No. E6.

SEPARATOR

Sheet steel separator by Basco automatically fans the top sheets of a stack for ready feeding to the press, saves time, injuries, expense. Requires no outside connections. 4 models.

Circle No. E1.

PAINT RUST!

New 'S. R. P.' special compound paints right over rust, gets down to base metal, chemically stops further rusting. Outlasts red lead in any condition, big application and first cost savings.

Circle No. E2.

FLAT STOCK

Analysis, heat-treat and tempering data, and easy-to-select tabular listing of stock sizes of DoALL ground flat stock are contained in bulletin 52-803, now available to readers.

Circle No. E9.

OIL ASSEMBLIES

Oilers, oil cups, vent tubes and tube forms are just some of the lubrication fittings described in this well constructed brochure. Pictorial index, clear compact specifications.

Circle No. E10.

MOTOR PUMP

This compact Barnes motor pump unit is made in a complete line from ¼ HP to 1½ HP, capacities 60-360 gallons per hour. Applications: fluid transfer, lubrication power tools, small presses.

Circle No. E3.

CUTS FRICTION

Folder on Molykote M-55 has all data on this highly successful additive to lubrication, coolant, and cutting oils, where high working pressures are a critical factor.

Circle No. E4.

TOOLROOM TESTED

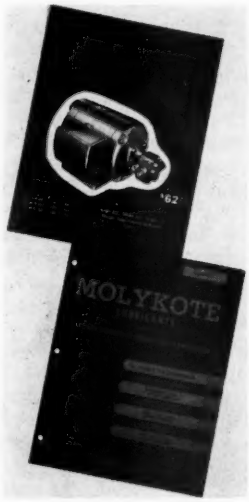
Folder describes a grinding wheel line by Mid-west Abrasive Co. proven in varied work-a-day applications. Special aluminum oxide grain. Excellent results, low first cost.

Circle No. E11.

SMALL PUNCHES

HSS punch line for small dia. close tolerance holes has 70 stocked sizes between .032" and .189" standard. All data on complete line is contained in this new folder.

Circle No. E12.



FREEZER LINE

Information on industrial freezers and complete temperature range testing unit is given example style in this bulletin. 12 models illustrate a range of 36 standard units.

Circle No. E7.

AIR CYLINDERS

New Bulletin #731 has complete Lindberg line. Diagrams, charts, and photographs explain capacity, type of mounting, etc. Listing of engineering features also included.

Circle No. E8.

. . . Screw Machine, from page 51

of the simpler form tools, turning tool blades, large counterbores, V-rests for box tools, and as knurl roller bearings where heavy pressures are encountered.

Both Dowmetal FS1 and M are preferred for screw machine stock although other extruded alloy material can also be used if special properties are desired. High speed tools such as taps and counterbores exhibit excellent tool life in the machning of the magnesium alloys; in many instances this tool life is equivalent to that of carbide tipped tools on other metals. Carbide tools will give still longer life and in many cases the higher initial cost of the carbide tool is more than offset by the savings effected through less downtime due to fewer tool resettings. Both the carbon and low alloy tool steels can be employed in machining this material by such operations as drilling, reaming, tapping, and finishing; high speed steel usually being the preferred.

The copper base alloys are divided into three groups based on machinability; this grouping is a rough classification and is a reasonable guide to relative tool life and the amount of power required in cutting. The line of demarcation between each group is not clear cut. Thus, these groupings are:

Group 1. The free cutting alloys, usually brasses to which a small percentage of lead has been added. This lead will vary from 1.0 to 4.0 percent on wrought bar stock,depending on the specific alloy type. The numerical ratings for the machinability of these alloys are from 70 to 100, using free cutting yellow brass which is rated at 100, as a base.

Group 2. The readily machinable alloys that have a numerical rating from 30 to 70. These are non-leaded compositions in-

. . . Continued on page 95

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You can reduce regrinds and rejects, and obtain higher finishes in a shorter grinding time when you use the new R3 Bond Rubber Raceway Wheels by CARBORUNDUM. This new bond permits use of coarser grit sizes which cut faster, maintain contours better, and still produce superior finishes. Single section wheels up to 1" thick in the new bond eliminate costly tandem mountings.

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- HOLD FORM
- GIVE HIGH FINISH

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I'd like more information on R3 Bond Rubber Raceway Wheels.

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81-33

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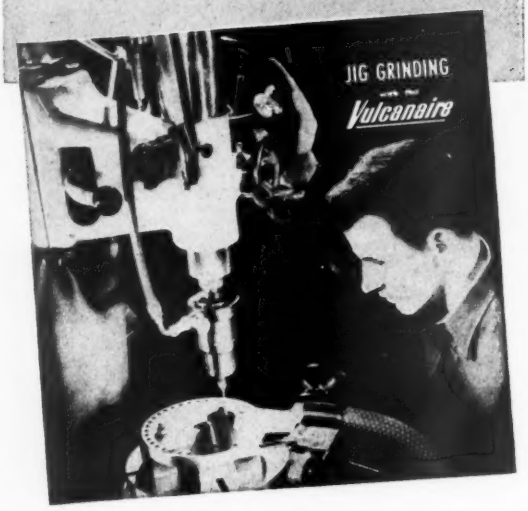
JIG GRINDING ACCURACY *guaranteed**



INFINITE CONTROLLED SPEEDS
30,000 TO 65,000 R. P. M.

Easily connect jig grinder to jig borer or mill

Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3 3/16" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

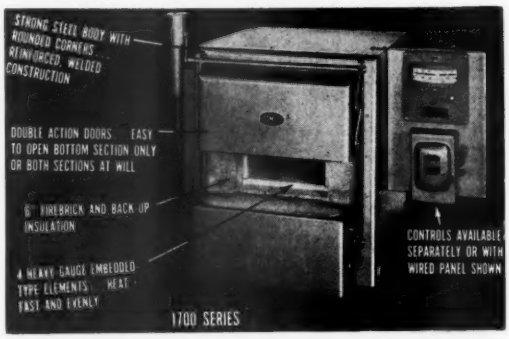
*Dependably accurate to "tenths"

Vulcanaire
BUILT BY TOOLMAKERS FOR TOOLMAKERS

VULCAN TOOL CO., PRITZ ST., DAYTON 10, OHIO

CUT HEAT-TREAT COSTS

. . . with this versatile Temco bench furnace
. . . for heat treating dies, parts, tools, etc.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DOUBLE ACTION DOORS . . . EASY TO OPEN BOTTOM SECTION ONLY OR BOTH SECTIONS AT WILL
9" FIREBRICK AND BACK UP INSULATION
4 HEAVY-GAUGE EMBEDDED TYPE ELEMENTS . . . HEAT FAST AND EVENLY
CONTROLS AVAILABLE SEPARATELY OR WITH WIRED PANEL SHOWN
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Speed production, lower unit costs with this husky electric furnace. Large enough to take a wide variety of work, yet compact and exceptionally convenient to use. Chamber sizes—9½" wide, 8½" high and 13½" or 18" deep. Heating range 350° to 1900° F., 220 V. operation. Price with controls, $297.50 to $507.50. Furnace only $235 to $285. Write for literature and nearest dealer's name.

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PRECISION KEYWAYS
with an *ADJUSTABLE* GLENNY PUSH BROACH

Production or short-run keyway cutting can be accomplished in all types of bushings, sleeves, gears, etc., with the GLENNY adjustable push broach. Featuring 0.0005-inch accuracy, it can be instantly adjusted and micrometer checked for precision operations.

SPECIFY GLENNY . . . greater strength . . . maximum accuracy . . . fully adjustable for depth . . . interchangeable high-speed blades . . . bushing adapters available . . . will cut tapered keyways . . . hardened tool-steel external parts . . .

GLENNY broach sets are available for cutting keyways in bores ranging in diameter from ¼ to 2½ inches.

181 KM

KASE MACHINE COMPANY
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Cleveland 19, Ohio

KASE MACHINE COMPANY
Please send (without obligation) your new Bulletin No. 13 containing sizes, specifications and prices of GLENNY broaches and kits.

NAME _____
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Air Force Subcontracting Lags

Many New England small business concerns are not taking full advantage of opportunities to obtain prime and sub-contracts in the United States Air Force's expansion program.

Out of 178 concerns listed recently by the Associated Industries of Massachusetts as electronics-manufacturing firms, only 24 have placed themselves on the Air Force bidder's list for urgently needed electronics equipment. According to a recent official report, ample opportunities are open for inclusion on this list; bid kits containing complete blueprints and specifications for each item are available for review, but "New England small business men are just not taking advantage of them."

The Air Force's program of expansion from its present 90 to 143 wings has made funds available for the procurement of thousands of items of equipment. Air Force spokesmen predict a great increase in procurement activities after January 1. It would seem that now's the time for all small business contractors to make full use of the opportunity. According to the report, in many cases small business men in the electronics field alone were not included in the bidder's list because they have not kept the Air Force up-to-date regarding their production facilities and progress. As a result, the Air Force's Small Business Office has no information on more than 150 Massachusetts firms that could probably supply much-needed parts. Other manufacturing fields show nearly the same degree of need.

Small business concerns in the New England States may be considered for prime contracts, or can be listed as potential first, second, and third-tier sub-contractors by filing necessary information at either of the two Small Business Offices operated by tthe Northeastern Air Procurement District. They are located at 500 Capital Ave., Hartford, and in Boston, at the Air Regional Office, 10 West St. Your procedures are officially listed as follows:- write or visit the small business office in Hartford or Boston; provide complete and up-to-date information for the forms used in preparation of the official index; and make periodic checks with the Small Business Office to examine bid board and kits.

TOCCO Contest Winners

The TOCCO Induction Heating Div., Ohio Crankshaft Co., Cleveland, has announced the 1952 winners of its 'Economy in Production' contest. Winner of the $1000 first prize was Lloyd E. Raymond, metallurgist at Singer Mfg. Co. His paper showed how the TOCCO process reduced sewing machine parts hardening time 62%.

Other prize winners and amounts won are as follows:

John P. Isaacs, Norris Thermador Corp., Los Angeles, $600. Henry C. Fisher, Army Chemical Center, Maryland, $600. R. H. Lauderdale, Northern Ordnance Inc., $400. J. C. Scullin, Cardinal Machine Co., $100.

Merit Award to S.F.S.A.

Steel Founder's Society of America, 50 year old technical organization serving the steel industry, has been cited for national recognition as winner of the 1952 Award of Merit conferred by American Trade Association Executives, international society of professional trade association executives.

Presentation of the award for distinguished service by a national association was based on the judgement of a five-man jury of awards of which Charles Sawyer, Secretary of Commerce, was the chairman. The Society maintains national headquarters in the city of Cleveland.

Positive Results
with
VISUAL GRIND
TESTED AND PROVEN SUCCESSFUL!
Progressive Die
Blanking Die
Flat Form Tool
Circular Form Tool
Dovetail Tool
Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Workpiece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.
Ask for Bulletin T-1
VISUAL GRIND
THE CLEVELAND GRINDING MACHINE COMPANY
1643 EDDY ROAD • CLEVELAND 12, OHIO
New Possibilities in Optical Grinding

Absolutely Guaranteed . . .

$22.50

VERDICT Model C

DIAL INDICATOR TEST SET

MADE IN ENGLAND

SPECIFICATIONS

Graduations ..... .001"
Range ..... .030"
Rotable Dial
Reversing movement
Contact ball operates within an arc of 180°

This indicator is ideal for bench and machine work. Countless test positions are made available by its size and versatility. Made of hard brass, dull nickel plated.

Supplied in a handsome case with universal holder.

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Repair Parts and Service Available.
Request information on other models.

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WALKER 5-4048 — 5090

KUTMORE ADJUSTABLE HOLLOW MILLS

DESIGNED FOR ALL YOUR HOLLOW MILL WORK

- ANY COMBINATION OF . . . TURNING . . . TAPERING . . . FACING . . . CHAMFERING . . . TREPANNING IN **ONE PASS.**
- EXCLUSIVE **MICROMETER** ADJUSTMENT FEATURE FOR RAPID SET-UP.
- CUTTING CAPACITIES FROM 1/32" TO 2" DIAMETER IN STANDARD STOCK.

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FOR PRECISION MEASURMENT OF:

"O" RING GROOVES
SNAP RING GROOVES
THREAD RELIEFS
ETC.

SIZES .300" to 6.000"

THE ORIGINAL INDICATOR GAGE DESIGNED FOR MEASUREMENT OF INTERNAL GROOVE DIAMETERS

For Information Write To

RIMAT TOOL CO., 27 W. Dayton St., Pasadena 2, Calif.

Industrial News

The B. F. Goodrich Company's engineering division at the Akron, Ohio plant has been named a first place winner in the National Safety Council's Metals Section safety contest for the year 1951-1952.

This particular contest is the largest conducted by the National Safety Council with 832 contestants representing all of the larger industries across the country. The award earned by B. F. Goodrich was for having the lowest injury rate in the machine shops group.

While the average for plants entered was 7.74 injuries per million manhours, the B. F. Goodrich engineering division had but 1.32 chargeable injuries during the contest period.

Severance Regrinding Service
☆ HIGH SPEED and CARBIDE ☆
CONSERVE STRATEGIC MATERIAL!

WE REGRIND: MIDGET MILLS, COUNTER SINKS, END MILLS, MILLING CUTTERS, PINKING CUTTERS ETC.
START USING THIS MONEY SAVING SERVICE NOW!
Severance Tool Industries Inc.
730 Iowa Ave., Saginaw, Mich.
Catalog Sent On Request

THE MODEL 1100 HYBCO TAP GRINDER

- Capacities No. 0 Mach. Screw to 1½" Hand Taps.

Representatives in Principal Cities

HENRY P. BOGGIS & CO.
704 East 163rd Street
Cleveland 10, Ohio

. . . Screw Machines, from page 91

cluding such materials as red brass, muntz metal, naval brass, tobin bronze, silicon brass and manganese bronze. It also includes the leaded compositions such as phosphor bronze, silicon brass, and nickel silvers.

Group 3. This is made up of those alloys which have a numerical rating of 20 or less and would include the non-leaded coppers, nickel silvers, phosphor bronzes and super nickel alloys. These alloys usually produce long, tough, and stringy chips.

On short runs, or where considerations do not warrant the use of a higher priced cutting tool, some economy may be effected by the use of either a carbon or low alloy tool steel. On moderate rates of production, high speed tools such as drills, taps, form tools, solid and insert tooth reamers, etc. are commonly used. Although the initial cost of high speed steel is greater, the results obtained often justify its selection. To reduce tooling cost there are available tools with high speed steel tips brazed to low alloy steel shanks.

Here again the carbide tipped tools are used to advantage for high production and long runs, particularly where a large amount of material must be removed as in the machining of large diameter work. The use of carbides permits much higher speeds with equivalent feeds than obtained with high speed steel tooling even when machining the so called difficult alloys, group 3. Thus, within this group, recommended speeds are between 75 and 150 feet per minute for turning, whereas with carbides these are increased to values from 250 to 600 feet per minute on roughing cuts and from 300 to 800 feet per minute on finishing cuts.

To be continued

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6. "U.S.S. Carilloy Steels", U.S. Steel Corp., Pittsburgh Pa.
7. "Tool Steels", Catalog No. 41, Vanadium Alloys Steel Co., Latrobe, Pa.
8. "Machining Copper and Copper Base Alloys", The American Brass Co., Waterbury, Conn.
9. "Machining Alcoa Alloys in the Screw Machine", Aluminum Co. of America, Pittsburgh, Pa.
10. "Heat Treatment of High Speed Steel" M. Cohen and P. Gordon, Vanadium Alloys Steel Co., Latrobe, Pa.

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Erickson Self-Releasing Tap Holder

Tap to Closer Tolerances at High Production Speeds...

With this member of the famous family of Erickson Precision Holding Tools, you can now produce any class fit at truly record breaking rates.

Review your present tapping operations. Learn how they can be improved by the Erickson Tap Holder's special features:

1. **Self-Releasing:** Positive, simplified releasing mechanism speeds production, prevents tap abuse.
2. **Corrects Misalignment:** Adjustable to correct spindle errors; extends useful life of machine.
3. **Positive Drive:** No interference with alignment. Same principle as used in Erickson's famous Tap Chucks.
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CATALOG A — *Precision Collet Chucks*

CATALOG B — *Adjustable and Full Floating Holders*

CATALOG C — *Precision Tap Chucks*

CATALOG D — *Air-Operated Speed Chucks and Air Cylinders*

CATALOG E — *Precision Expanding Mandrels*

CATALOG F — *Speed Indexers*

CATALOG G — *Boring and Reaming Tools*

ERICKSON TOOL COMPANY

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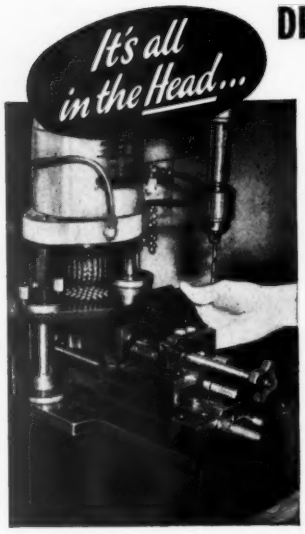


DRILLING HOLES AT IBM

• No time lost drilling millions of holes in business machine parts. IBM cashes in on the many features of Zagar Gearless Drillheads: many holes drilled at one pass; any number of holes in any material in any pattern as close as twice drill diameter; accurate spacing maintained. Standard Zagar Gearless Drillheads can be adapted readily to your needs. Send us your parts drawings.

◄ 110 holes on 3/8" centers are drilled in the inserts of molded phenolic block. 20 drills in head; 6 feeds to complete each block.

Get Engineering Manual T-1 for more information on all Zagar's tools for industry.

★ ★

ZAGAR TOOL, INC.
24000 LAKELAND BLVD.
CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Tooling News from the SMALL DEFENSE PLANTS ADMINISTRATION

Information has been received from Mr. William S. Hug, Regional Representative of Region VI, that Small Defense Plants Administration has announced that a Joint Determination has been made for Small Business to supply miscellaneous Tools, Dies, Jigs and Fixtures.

This program will require first class equipment, workmanship and "know-how". Tolerances in "tenths" on hole centers, as well as other critical dimensions, will be required. Sources to be considered must have surface grinding equipment, milling machines, jig borers, and radial drills, as well as other high quality tool room facilities.

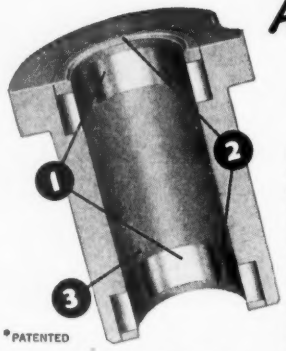
Firms replying will be carefully screened, and if found to be qualified will be listed to receive bidding information and prints.

Please note that no progress payments will be made. However, payment on delivery of partial shipments, inspected—approved, can be made.

Those interested, after considering the high quality of the work required, are urged to get in touch with the nearest SDPA Regional or Branch office at once (presenting facilities listing and qualifications) and requesting consideration.

See opposite page for directory of regional and branch offices of the SMALL DEFENSE PLANTS ADMINISTRATION.

MORE HOLES— MORE ACCURACY— FASTER— AT LESS COST



MEYCO
Carbide Inserted Bushings
Are Doing It Daily!

*PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

For information and prices write for Meyco Bushing Catalog No. 17

HOW? Like this: (1) Last longer... with a life—in most cases—as long as solid carbide bushings at prices that come close to the prices of ordinary steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

W. F. MEYERS CO., INC., BEDFORD, INDIANA

LIFT HEAVIER LOADS SAFELY
WITH A FROOM
load centering EYE BOLT

More than an eye bolt... a necessary tool for all shops. Perfect load centering action aligns the load every time. The strain on bolt threads, which causes ordinary eye bolts to break off, is eliminated. Heavy objects can be lifted safely... moved faster ...subjected to intermittent jerks and strains without fear of eye bolt shearing off.

Protect your valuable machinery, dies tools, etc., with the safer, longer lasting Froom Load-Centering Eye Bolt. They are made from high grade steel having ductility and toughness far greater than commercial steel. Thousands in use in all industries. Prompt Delivery on Stock Sizes.

½" to ⅝"—$11.75 each
¾"—$13.50 each
⅞" to 1"—$23.50 each
Prices F.O.B. Los Angeles

Special size on quotation.
When ordering, specify amount and bolt thread size.

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Region I: Mass., Conn., Maine, N. H., Rhode Island, Vermont
Edward J. Stewart
Regional Director
Small Defense Plants Administration
40 Broad Street,
Boston 10, Mass.
Phone: Hubbard 2-6200
Ext. 96

Region II: New York and New Jersey
Casper H. Citron
Regional Director
Small Defense Plants Administration
2 Park Ave.,
New York 16, N. Y.
Phone: CHickering 4-6157

Region III: Pennsylvania & Delaware
Joseph G. Dellert
Regional Representative
Small Defense Plants Administration
1015 Chestnut St.,
Philadelphia 7, Penna.
Phone: Walnut 2-1145

Region IV: Virginia, D. C., Maryland, North Carolina & West Virginia
Leon E. Savage
Regional Director
Small Defense Plants Administration
Southern States Bldg.
Richmond 19, Va.
Phone: Richmond 3-3561

Region V: Georgia, Alabama, Florida, Miss., South Carolina & Tennessee
Hugh Mitchell
Acting Regional Director
Small Defense Plants Administration
50 Whitehall St.,
Atlanta, Georgia

Region VI: Ohio, Kentucky & Michigan
William S. Hug
Regional Representative
Small Defense Plants Administration
248 Ferguson Bldg.,
Cleveland 14, Ohio
Phone: CHerry 1-7900
Ext. 580

Branch Office—Region VI
James B. Shepard
Field Representative
Small Defense Plants Administration
912 Francis Palms Bldg.,
Detroit 1, Michigan
Phone: Woodward 3-9060

Region VII: Illinois, Indiana & Wisconsin
Von Allan Carlisle
Acting Regional Director
Small Defense Plants Administration
188 W. Randolph St., Room 901
Chicago 1, Illinois
Phone: Dearborn 2-4500
Ext. 571

Region VIII: Minn., Montana, N. D. & S. D.
J. Walter Malmquist
Regional Director
Small Defense Plants Administration
220 Minnesota Federal Bldg.,
Minneapolis 2, Minn.
Phone: Main 3244

Region IX: Missouri, Iowa, Kansas & Nebraska
Roy W. Webb
Regional Director
Small Defense Plants Administration
Federal Office Bldg., Room 405
Kansas City 6, Mo.
Phone: Baltimore 7000
Ext. 591

Region X: Texas, Ark., Louisiana & Okla.
Henry H. Ritter
Acting Regional Director
Small Defense Plants Administration
1114 Commerce St.,
Dallas 2, Texas
Phone: Riverside 6951
Ext. 2248

Region XI: Colo., N. Mex., Utah & Wyoming
Lacy Wilkinson
Regional Director
Small Defense Plants Administration
New Customhouse, Room 406
Denver, Colorado
Phone: Keystone 4151
Ext. 8298

Region XII: Calif., Ariz., & Nevada
Joseph V. Ragusa
Regional Representative
Small Defense Plants Administration
Flood Bldg. Room 586
San Francisco 2, Calif.
Phone: Yukon 2-5800
Ext. 150

Branch Office—Region XII
Joseph V. Ragusa
Regional Representative
117 West 9th Street
Los Angeles 15, Calif.
Phone Prospect 4711
Ext. 321

Region XIII: Wash., Idaho & Oregon
Allan L. Willard
Regional Director
Small Defense Plants Administration
Burke Bldg., Room 328
Seattle, Wash.
Phone: Eliot 9010
Ext. 131

Zagar 5-C pull type collet
Zagar 2" holding fixture
Zagar 1" indexing fixture
Hold on, there!
there's nothing better than a good watch-dog

Depend upon
Zagar FIXTURES, too!

When all is said, this is the first, middle and last consideration — that fixtures, holding and indexing, must HOLD. On that score, Zagars have qualified famously for years — in simple and intricate machining operations. Accurate construction gives accurate performance. Zagar also has a complete line of air-operated holding fixtures and collet lathe chucks. Prompt deliveries *NOW!*

Write for Engineering Manual T-1.

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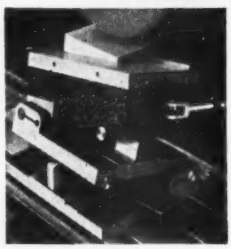
Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

ANGULAR SET-UPS

to gauge-block accuracy
IN A FEW MOMENTS



the Magna-Sine

Any angular set-up, single or compound, takes only the time to look up the angle in the Robbins Table of Constants and to insert the indicated gauge blocks between the Magna-Sine plates. It's fast—it's positive, to gauge-block accuracy. Work is held by magnetic attraction. In two models and two sizes; also in non-magnetic models for inspection work.

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OMER E. Robbins COMPANY
Manufacturers of the MAGNA-SINE and Other Precision Tools
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Your Entire Stock of Drills...
Seen at a glance

HUOT DRILL DISPENSER

for
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Saves Time hunting through stacks of packaged drills. Compartments hold a gross of small sizes—a dozen or more of the larger ones. Raised letters on easy sliding drawers . . . hammerlin gray baked enamel finish . . . 14½"x7¼"x7¼".

Write for Circular
Model No. 1: Fractional drills 1/16" to 1/2"
Model No. 2: Number drills 1 to 60
Model No. 3: Letter drills A to Z

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581 NORTH WHEELER ST. PAUL 5, MINNESOTA
Huot is pronounced "Hew-ot"

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F. W. GOTTSCHLING

JOHN E. G. KLINE

DOUGLAS T. PEDEN

PAUL PORTERFIELD

H. H. LENTZNER

★

Greer Hydraulics, Inc., Brooklyn, announce the appointment of F. W. Gottschling as administraäve engineer, assistant to the president and chief engineer, Mr. Edward Greer. He will supervise the scheduling of all engineering projects, manpower and coordination.

Kirke W. Conner, president, Micromatic Hone Corp., announces the elevation of John E. G. Kline to vice president in charge of process development and patents; and of Douglas T. Peden to vice president in charge of research and experimental. Kline began his association with the hone abrading industry as a consulting engineer in 1928, has been with Micromatic since 1937. Peden joined Micromatic in 1938, and has a record of over 30 years experience in machine tool design and development.

Paul Porterfield was recently appointed general manager of the Method X Co., an affiliate of Firth Sterling, Inc. Formerly Mr. Porterfield was an electronic engineer for the Chesapeake & Ohio Railroad Co., where he was in charge of their entire electronic program.

H. H. Lentzner, who has been named manager of the newly created special machinery division of the Kearney & Trecker Corp., has been with the company for some 30 years. After a position in the late 30's as a district sales representative, he returned to Milwaukee in 1941, and has since been sales manager and director of a special engineering investigation service.

DIECO Die Sets
1728 Combinations
All-Steel Semi-Steel
special and standard

DIECO Guide Pins and Bushings
Precision, Commercial and Shoulder

DIECO Die Springs
500 Stock Sizes
3 pressures:
Medium, Medium-High and High

for Finer Precision, Higher Quality for Better Production, Bigger Profits

Performance is proof! DIECO customers report: "Smoother operating DIECO Die Sets boost production. Need no prybars. Longer die life. Less down time. DIECO Die Sets are manufactured by Die Supply in Cleveland—means better service! DIECO Guide Pins, Bushings, and Components interchangeable with finest precision fit—operate better, longer. DIECO Springs outperform others 3 to 1 *and better*. Greater travel, more usable pressure, longer life. Demand DIECO for *all* your tool, die and machine shop accessories. Ask for catalogs.

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PITTSBURGH 6: 122 S. Sheridan Ave. • EMerson 1-0440
BUFFALO 1: Die Supply Corporation, 234 Carolina St. • MAdison 1964
DAYTON 4: The Die Supply Sales Co., 311 Vermont Ave., MIchigan 9691 • TWX-DY-85

. . . . . MEN YOU SHOULD KNOW

RICHARD J. MULRONEY

RUSSELL E. LONG

RODERICK L. SMITH

PHILIP H. THRESHIE

G. KRAUSE

★

Richard J. Mulroney and Russell E. Long, joint partners of the Mississipi Supply Co., have been named distributors of the products of the Industrial Truck Division of Clark Equipment Company. Mulroney and Long are both graduates of the Armour Institute of Technology. In 1938 they formed their company. Since then neither partner has confined his activities exclusively to this enterprise. From '41-'52 Mulroney specialized in the sale of materials handling equipment to railroads.

Roderick L. Smith has been appointed field engineer in the Chicago territory for the Norton Co., having been with the company since early 1951. First he served as a sales trainee, being appointed grinding engineer in Sales Engineering Dept. in September of that year. Philip H. Threshie, Jr., was appointed field engineer in the Pacific Coast district on December first. He also has been with Norton since 1951, joining as a sales trainee. He was previously employed as assistant purchasing agent for Acushnet Process Co.

Mr. G. Krause has been appointed chief designer of Loewy Construction Co., subsidiary of Hydropress, Incorporated, New York, in charge of the United States Air Force Heavy Press Program.

IN STOCK

Metal Working & Draftsman's

*For complete dependability and exactitude Marshall Steel Straight Edges are tested for their precision and accuracy. Every straight edge shipped is individually double-checked for finish and straightness.

Marshall Steel Company have equipped themselves with a ground steel check table 15 ft. long and a Watt's Autocollimator and auxiliaries. The same equipment and method of testing straight edges as is used by the United States Bureau of Standards at Washington, D. C.

Write for required size and prices. We now have all sizes in stock.

Also write for new Catalog on the largest range of sizes of velvet finish GROUND FLAT STOCK in 3 kinds: WATERcrat, OILcrat & AIRcrat . . . truly the ARISTOCRATS OF GROUND TOOL STEEL.

MARSHALL STEEL CO.
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The Aristocrats of Ground Tool Steel

WATERcrat OILcrat AIRcrat

P. O. BOX 108 TP LA GRANGE, ILLINOIS

MEN YOU SHOULD KNOW . . . . . .

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Arma Corporation

BOB DANDO

Standard Pressed Steel

R. A. HAMILTON

Farrand Optical Company, Inc.

GEORGE A. PARK

Norton Company

WARREN G. ROSENDAHL

Columbia Machinery & Eng'g. Corp.

★

Douglas R. G. Williams has been appointed staff assistant, Mfg. Div., of the Arma Corp., subsidiary of American Broach Corp. He comes to Arma after ten years of service with Behr-Manning Corp.

Bob Dando, a salesman in the St. Louis area for the last six years, has been transferred by Standard Pressed Steel Co. to the Philadelphia territory. He has been with SPS since 1942, progressively holding posts as inspector, in sales promotion and in adjustment.

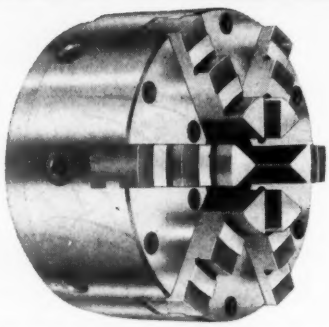
According to a recent announcement Mr. R. A. Hamilton has recently become associated with Farrand Optical Company, Inc., in the capacity of consulting engineer in the optical tooling division. Mr. Hamilton is well known in the aircraft tooling industry, having materially contributed to methods, procedures and techniques in jig and fixture construction.

George A. Park, Norton Co. sales manager, eastern region, has been appointed manager of distributor sales. This new position was created to increase Norton's abrasive and grinding wheel participation "in the thousands of accounts which are handled by distributors," according to official announcement.

Warren G. Rosendahl was recently appointed director of manufacturing for the Columbia Machinery & Engineering Corp., of Hamilton, Ohio.

Buck ADJUST-TRU CHUCKS

The UNIVERSAL Chuck with .0005 PRECISION!



6 Jaw 6" Chuck Handles Work of 93 Collets!

The capacity of $1,000 worth of collets for your tool room PLUS scroll chuck rechucking speed on duplicate parts with .0005" precision . . .

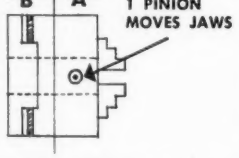
The firm grip of 6 jaws for soft metal or tube work . . .

An end to most needs for stub arbors, mandrels, or special fixtures . . .

A reliable precision chuck adaptable to lathes, screw machines, grinders, dividing heads . . .

The greatest development of recent years to save machinists' time . . .

That's the brief story of this sensational Adjust-Tru chuck. It is unbelievable — but true! Send for catalog with full details.



HOW and WHY it works

Chuck gripping section "A" is like any scroll chuck with **one pinion to move** jaws. (accurate to .003"). Section "B" shows how chuck "floats" on adapter (.020" clearance) where 4 opposed screws **move chuck on adapter** for adjustment to dead true precision. Jaws always come back within .0005" on duplicate work.

SIZES AVAILABLE:

3- and 6-Jaw Chuck — 4" (light duty); 5", 6", 7½" (heavy duty)

2-Jaw Aviation Chuck — 6", 7½" (heavy duty)

BUCK TOOL CO.

11A Schippers Lane • Kalamazoo, Mich.

. . . . . MEN YOU SHOULD KNOW

WILLIAM J. PINKERTON

Micromatic Hone Corporation

ARTHUR B. KOWALSKI

Micromatic Hone Corporation

MYRON P. ELLIS

Micromatic Hone Corporation

E. W. RISTAU

Delta Power Tool Division

JOHN STOLARZ

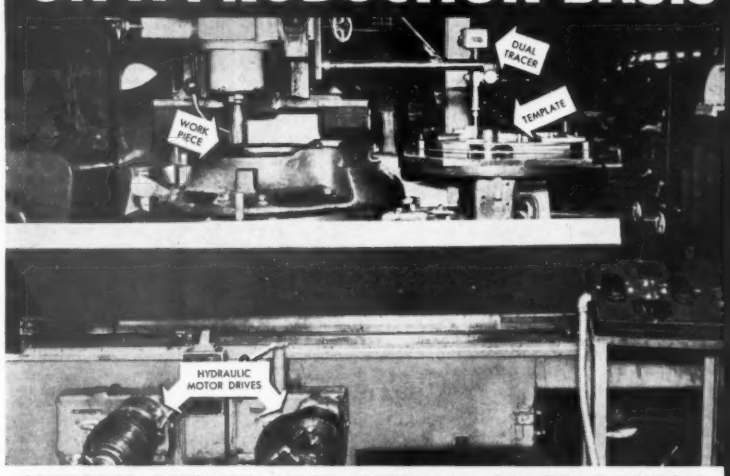
Delta Power Tool Division

★

Kirke, W. Connor, president, Micromatic Hone Corporation, Detroit, recently announced the following changes in staff appointments. William J. Pinkerton, formerly director of public and industrial relations, is elevated to vice president in charge of manufacturing. Arthur B. Kowalski assumes the position of factory manager, formerly held by the late Herman Thaler. Myron P. Ellis advertising manager.

Rockwell appoints Ristau and Stolarz. E. W. Ristau was recently appointed director of sales and advertising, and John Stolarz as sales manager of the Delta Power Tool Div. by Rockwell Manufacturing Company. Mr. Ristau has had a long successful experience in industrial distributor sales, has been associated with Skilsaw, Inc., where he became vice president in charge of sales and advertising. After this he served as president of Aristo Power Tools, and as vice president of the Cummins Portable Tools Div. He joined Rockwell in 1951. Mr. Stolarz has been associated with the power tool industry for 17 years. He started with DeWalt, Inc., and served them successively as sales manager, advertising manager, and export manager. He joined the Rockwell Group in 1949.

DUPLICATE MACHINED PROFILES and CONTOURS ON A PRODUCTION BASIS



PERFORM INTERNAL AND EXTERNAL CONTOUR WORK ON LATHE OR MILL... *at low cost!*

Original accuracy, normal cutting speeds, simple operation. (1) Controls two feeds simultaneously. (2) Does not interfere with conventional use of machine. (3) Applicable to most standard machine tools . . . This may be the answer for which you have searched . . . Write for our catalog.

90° shoulder and contour on lathe work

TRACER CONTROL CO.

Distributors for Lodge & Shipley Duplicator

595 E. 10 Mile Road • P. O. Box Q • Hazel Park, Mich.

DO YOU NEED

Surface Grinding to Gage Tolerance?

Dependable Grinding Performance in Production?

. . . if so, Boyar-Schultz No. 6-12 is the Surface Grinder for YOU!

It has the capacity to handle the biggest part of the tough assignments encountered in any shop. It has the accuracy to obtain the high precision needed in tool and gage making. In production it proves so sturdy that long runs, with accuracy, are no problem.

The Boyar-Schultz No. 6-12 Surface Grinder is very much in demand in our own shop! Our mechanics *know* its built-in qualities . . . they like to use it.

BIG MACHINE PERFORMANCE—Small Machine Cost

BOYAR-SCHULTZ CORPORATION

2112 WALNUT STREET • CHICAGO 12

— CONTRACT TOOLING AND PRODUCTION —

Illinois

DRESEL-BETZ CO.
Belleville, Ill.

Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings.

Michigan

DAVIS TOOL AND ENGINEERING CO.

19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery. Sheet Metal Stampings and Assemblies.

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CAZENOVIA
PRECISION MACHINE CO., INC.
669 Oakwood Ave. East Aurora, N. Y.
Telephone: 1561
Special Machinery • Tools and Gages
Small Lot Production
Design & Engineering Facilities Available
Precision Hand Scraping

AMERICAN MEASURING INSTRUMENTS CORP.

The AMIC Bldg., 21-25 44th Ave., Long Island City 1, N. Y. Jigs, fixtures, gages, dies, precision parts.

CONRAD & MOSER

2-23 Borden Ave., Long Island City, N. Y. Machine Tools & Molds, Parts & Machines Aluminum Cast Parts, Aluminum Sheet Formed Housings.

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CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, O., MU 1-2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
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WO 1-4736

Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

H & P DIE STAMPING CO.
13947 Triskett Rd. Cleveland 11, Ohio
PRECISION DIES, JIGS & FIXTURES
Quality Stampings
Bus & Trailer Parts

THE INDUSTRIAL MACHINE CO.

1436 East 47th St., Cleveland, O. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.

5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.

998 Broadway, Bedford, Ohio, Bedford 2-1234. Tool Makers—Short Run Production Work.

THE PHOENIX MACHINE CO.

2711 Church Ave., Cleveland, O., CHerry 1-1048. Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines.

A. P. SCHRANER & CO.

3338 Payne Ave., Cleveland, O., HEnderson 1-8644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures.

TOOLCO COMPANY

Box 172A3, Glendale-Milford Road, Sharonville, Ohio, PH: Sycamore 6343. Small Tools, Dies, Jigs, Fixtures and Special Equipment. Parts Production Runs. Catering to Radio Electronics and Instrument fields of Industry.

Clamping With Toggle Clamps

Toggle Clamps Adapted to Plug Weld Fixture

Toggle clamps have been adapted to a fixture for plug welding operations on metal-folding wall tables by the Schieber Manufacturing Company. Experience shows that the clamps have boosted production and cut labor costs to a minimum.

After the table top has been deburred, it is placed on the hydraulic tilting table and the stainless band is clamped in place by the toggle clamps. By means of compressed air the table is tilted into position for the plug welding application. Ninteen toggle clamps and one U clamp with a double hold bar are used to obtain constant pressure of the stainless steel band to the table tops. These particular types of toggle clamps permit ease of insertion and removal of the steel table tops from the fixture, which make them the ideal choice for this application.

The Schieber "In-wall" tables and benches permit economy in the utilization of space in schools, clubs, churches, community houses and industrial buildings.

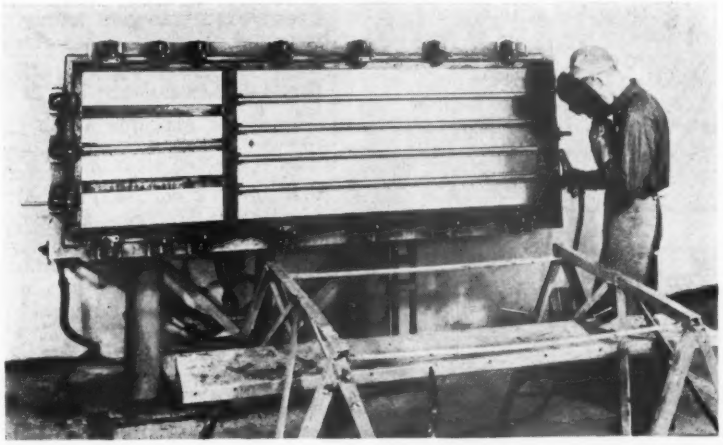
Photos courtesy Detroit Stamping Co.

Toggle Clamps Provide Pressure for Plastic Mold

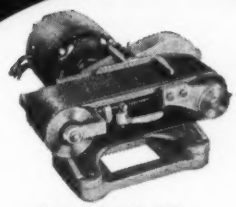
Development of a plastic mold designed around toggle clamps is announced by Palmer Plastics, Inc. The custom mold is producing ventilator doors for Freuhauf insulated trucks and semi-trailers. The light weight plastic fiber glass doors permit nearly 50 per cent weight savings.

Four plunger type clamps provide the necessary pressure to mold the fiber glass laminated insulation for the ventilator doors. The clamps are attached to the upper mold by a locking lug with adjusting thread screws. Linking extension handles, which permit leverage to open and close the mold, are attached with arms which ride in a channel to synchronize the action of the four clamps. The upper half of the mold is counter balanced to aid opening and closing.

In the manufacturing of the door panels, the fiber glass insulation is cut to size, sprayed with a bonding agent and covered with a fiber glass mat which makes up the preform. The pre-form is sprayed with an additional bonding plastic and placed in the mold which is electrically heated and controlled by thermostats. After cooling, a double weatherseal plastic gasket and hardware are mounted on the panel and the ventilator door is completed.



DOES IT BETTER
DOES IT FASTER



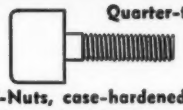
SIMPLEX-M
ABRASIVE BAND GRINDER

The precision of a machine tool plus the durability of a workhorse. Complete with ½ H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

WALLS SALES CORP.
333 Nassau Avenue, Brooklyn 22, N. Y.

REID TOOLING AIDS

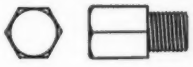


Quarter-turn Screws, assorted sizes.

T-Nuts, case-hardened for all standard T-slots.

Coupling Nuts, case-hardened.

Studs — also T-slot bolts.



Jig feet or rest buttons — hexagon and circular.

Also hand wheels, machine handles, levers, cranks, fixture units, magnetic parallels, machine vises, cast iron knobs. Write for catalog and prices on complete REID line.

REID TOOL SUPPLY CO.
709 Baker St., Muskegon Heights, Michigan

PUBLICATION

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

New Catalog of Routing and Milling Cutters. Containing a comprehensive listing of spiral routing bits and carbide milling cutters, this new bulletin has many helpful diagrams and practical working instructions, as well as specifications and prices on hundreds of bits and cutters of various types. It's available from Onsrud Cutter Mfg. Co., Eng'g. Dept., 800-820 E. Broadway, Libertyville, Ill., and represents a dependable, authoritative source of up-to-minute information.
Circle Inform-A-Gram No. B1.

"Precisioneerd" Vernier Height Gages, their uses and advantages, are discussed in a new catalog from Homestrand, Inc., Larchmont, N. Y. Three different applications are shown, with photographs and descriptions.
Circle Inform-A-Gram No. B2.

"How One Press Does The Work of Two" is title of stimulating new bulletin, No. 219, from the Clearing Machine Corp., 6499 West 65th St., Chicago 38, Ill. Performance characteristics of the Clearing are graphically given.
Circle Inform-A-Gram No. B3.

FLEXIBLE SHAFT TOOLS

SEND FOR BULLETINS!

Complete bulletins and operating data are quickly available. Send today, stating your particular production problem. Use the Coupon.

Whether you're finishing a casting, a weld, a fine die or stainless steel surface, you'll get the equipment that will do the job best from the best-known name in flexible shaft equipment—Haskins. Here is a company with a world of finishing experience to offer you—and a line of flexible shaft equipment in which long-life, multiple usefulness and economy have never been sacrificed to price.

R. G. HASKINS COMPANY 2647 W. Harrison St., Chicago, Ill.

Send data on Haskins equipment for _____ (state operation)

Name _____

Firm Name _____

Street address _____ City _____ State _____

New Benchmaster Belt Sander designed for all fine grinding, burring, and polishing operations is described in literature now available from the Benchmaster Mfg. Co., Gardena, Calif. Many well-engineered features including a unique trackage adjustment assuring positive wheel alignment and a pivoted backup unit which retains parallelism with the belt at any angular setting of the table.
Circle Inform-A-Gram No. B4.

Ex-Cell-O's New General Products Catalog shows in condensed form virtually all the company products, and also proves helpful in checking basic machine specifications and product descriptions. It is easily possible to determine what additional literature is available to give you more information and complete specifications on any particular machine or product. Included are precision boring machines; jet blade finishers; hydraulic power units; special machines; thread and tool grinders; mills, cutting tools, broaches and counterbores. From the Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 32, Mich.
Circle Inform-A-Gram No. B5.

Nine Different Types of Materials Handling Grabs, which have just been developed by Shur-grab Grapples Div., Eastern Brass & Copper Co., Inc., 1122 E. 180th St., New York 60, N. Y., are described in a catalog just released. They are representative of a line of equipment successfully designed to give standards of convenience, speed, and safety in heavy materials handling not previously thought possible.
Circle Inform-A-Gram No. B6.

Imported Machine Tools in an absolutely exhaustive listing of types and sizes are illustrated in the latest brochure from Morey Machinery Co., Inc., 410 Broome St., New York 13, N. Y. Also given deserved prominence in the attractive brochure are the Morey manufactured line of lathes, shapers, and profilers. Plus long listing of famous name machine tools now ready for immediate distribution.
Circle Inform-A-Gram No. B7.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

1953 Mead Air Power Catalog Just Off Presses. Contains 56 pages. The complete Mead line of single and double-acting air cylinders, and air operated presses, vises, chucks, valves, hammers and work feeders are designed to be combined with your machines to bring faster, money-saving production. Copies from Mead Specialties Co., Dept. P-32, 4114 North Knox Ave., Chicago 41, Ill.
Circle Inform-A-Gram No. B8.

Full Line of Tungsten Carbide Products, including cutting tools, draw dies, bushings, gages, centerless blades, rolling mill work, rolls, diamond wheels and wheel dressers, and solid carbide stock, are featured in a new 72 page general catalog 52-G from the Metal Carbides Corp., Youngstown, Ohio. Extensive engineering data is included on speeds and feeds, brazing and grinding instructions, grinding wheel recommendations, coolants, etc. and many new items.
Circle Inform-A-Gram No. B9.

Twist Drill Catalog New from the DoALL Company, Des Plaines, Ill., covers wide type variety including straight and taper shank; three and four fluted; heavy duty and high helix types, etc. Also drill sets, drill and reamer blanks, countersinks, taper extension sockets, sleeves and holders. Plus—instructions for drill pointing, web thinning, and a drill size decimal equivalent table. Bulletin 51/816.
Circle Inform-A-Gram No. B10.

Complete Line of Circular Sawing Equipment by Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, Ohio, is described in latest bulletin. Saws, Blades, and Grinders in related models for all purpose cut-off, slitting, and slotting. Full specifications. Saws blades utilize famous "Triple-Chip" principle for maximum efficiency and blade life.
Circle Inform-A-Gram No. B11.

Black Silicon Carbide Wheels specially designed for grinding carbide tools are featured in a new circular from the Macklin Co., Jackson, Mich. The circular gives helpful data on different grain structures for various jobs.
Circle Inform-A-Gram No. B12.

Improved Tools Catalog contains a useful list of decimal equivalents and on 82 models of regular and custom built pliers, and on a complete line of adjustabel wrenches. The catalog number is 66-1952, by the Utica Drop Forge and Tool Corp., Utica 4.
Circle Inform-A-Gram No. B13.

Conversion of Standard High Speed and Carbide Cutting Tools into specials is described in a new pamphlet to be distributed by Rutland Tool Service, 1617 E. McNichols Rd., Detroit 3, Mich. Use our Inform-A-Gram Card.
Circle Inform-A-Gram No. B14.

New Catalog on Cutters for Non-Ferrous Metals includes special design cutters required in aircraft. The catalog is exceedingly informative, contains total of 49 illustrations showing close-ups, working, and cut-away views of carbide and high speed steel cutters. Applications, types, prices, sizes and all other necessary data are thoroughly listed for benefit of production, engineering and purchasing men. Copy from Onsrud Cutter Mfg. Co., 824 East Boardway, Libertyville, Ill. Catalog 52-A.
Circle Inform-A-Gram No. B15.

It's a Hamilton

INDEED

There is no way under the sun to do small, precision tapping with "production" speed, satisfactory tap life and acceptable accuracy, other than to use a tool designed for the specific purpose.

THE *Hamilton* SUPER-SENSITIVE SMALL HOLE TAPPING MACHINE *IS SUCH A TOOL!*

The complete story of this machine is told in our Bulletin T-471. IT'S FREE. ASK FOR IT!

THE *Hamilton* TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

Light Gage Sheet Metal Working Machines and tools are the subject of booklet No. 200-H, just released by Niagara Machine Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y. Folders and brakes; rotary electric combination machines; slip roll formers; squaring shears; hand and bench tools and power presses are representative of the line described. Booklet is ideal for anyone needing clear concise picture of just what is available in this type equipment.
Circle Inform-A-Gram No. B16.

New from Marshall! Marshall Steel Co. have added a new line of straight edges which they now stock in all sizes. Every piece is individually double checked for finish and straightness by the same methods and instruments used by the U. S. Bureau of Standards. Also a new catalog of prices on the largest range of sizes of ground tool steel available. These are "WATERcrat," "OILcrat," and "AIRcrat," the "ARISTOcrats" of ground flat stock. Write Box 108-TP, Lagrange, Ill. for literature.
Circle Inform-A-Gram No. B17.

JIG and FIXTURE
COMPONENT PARTS
Eliminate the designing and making of clamps and other fixture parts.
LODDING makes them for you . . .
Large Factory and Distributor Stocks Assure Quick Deliveries.
LODDING
Write for CATALOG showing 365 items that can save you time and money.
LODDING, Inc.
WORCESTER, MASS.

Anarust, Liquid Rust Inhibitor for Wet Blasting Machines, is now available from stock from American Wheelabrator and Equipment Corp., 1183 S. Byrkit St., Mishawaka, Ind. It is of organic composition, contains no chromates, and may also be safely used on parts prior to such operations as plating, enameling, etc. Full physical and other data from manufacturer.
Circle Inform-A-Gram No. B18.

Complete Exhaustive Listing of Universal Joint Line for industrial and aircraft applications is contained in a new catalog from Apex Machine & Tool Co., 1068 So. Patterson Blvd., Dayton 2, Ohio. Featured are application data sheets for thorough application analysis. Three different series are described with full data, tables, charts, photographs, and graphs.
Circle Inform-A-Gram No. B19.

Stabilized Stainless Steel Tubing—Croloy 18-8 Ti (AISI Type 321)—is discussed in bulletin TDC-144 from Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa. Included are condensed data on corrosion resistance, creep strength, oxidation resistance, mechanical and physical properties, machinability, welding characteristics and heat-treatment.
Circle Inform-A-Gram No. B20.

"Spee-Dee" Whiteprinting Outfits for plants, offices, and schools are fully described in an informative new bulletin from Peck & Harvey, 5736 N. Western Ave., Chicago 45, Ill. A full range is described. Also helpful facts on the process and suggestions about printing and developing for speed, economy, and utility.
Circle Inform-A-Gram No. B21.

Bulletin has 16 Pages on Taps: is published by the DoALL Co., Des Plaines, Ill. Each of the many illustrated types is fully detailed, while ordering information is set up in chart form for penultimate convenience. Handy charts also give drill sizes for various thread dimensions. Bulletin 51-813.
Circle Inform-A-Gram No. B22.

Power Screwdrivers, Motorized Hopper Units, nut drivers and special assembling machines are all described in a bulletin from Detroit Power Screwdriver Co., 2827 W. Fort St., Detroit 16, Mich. Screws may be driven as fast as one a second.
Circle Inform-A-Gram No. B23.

"O-Vee" Thread Measuring Gauges are based on the three wire method of thread measurement. Overcomes the limitations of ring and other type gauges by indicating actual thread size and pitch diameter without the necessity of calculations or reference to tables. Complete information on an exhaustive listing of sizes and thread types contained in a bulletin newly available from the O-Vee Spring Gauge Co., 2516 W. Vernon Ave., Los Angeles 8.
Circle Inform-A-Gram No. B24.

Latest Model Simplimatic Automatic Lathe is covered in brand-new 1953 catalog from Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis. First 7 of the sixteen pages are devoted to the machine, construction features, specifications, possible variations. The last nine pages show 31 tooled applications from flywheels to rear axle housings. Informative, stimulating, attractive.
Circle Inform-A-Gram No. B25.

Magnetic Base Units and Accessories have combined a wooden display chest set by Cullen Mfg. Co., 1318 Clark St., Racine, Wis. Complete set of precision indicator bases; models No. 600 and No. 700 inspection lights; two models of Plexiglas safety shield and model No. 800 four power magnifying glass are all included. This is the well-known Erick Magna Holder line. Full data—Cullen Mfg. Co., 1318 Clark St., Racine, Wis.
Circle Inform-A-Gram No. B26.

New Profilometer Catalog Announced. From the Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. Includes sections giving overall view of the Profilometer line; and sections covering Amplimeter equipment, tracers, manual and motor driven piloting equipment, and equipment in development. Each item is described in detail with full specifications and shown in use.
Circle Inform-A-Gram No. B27.

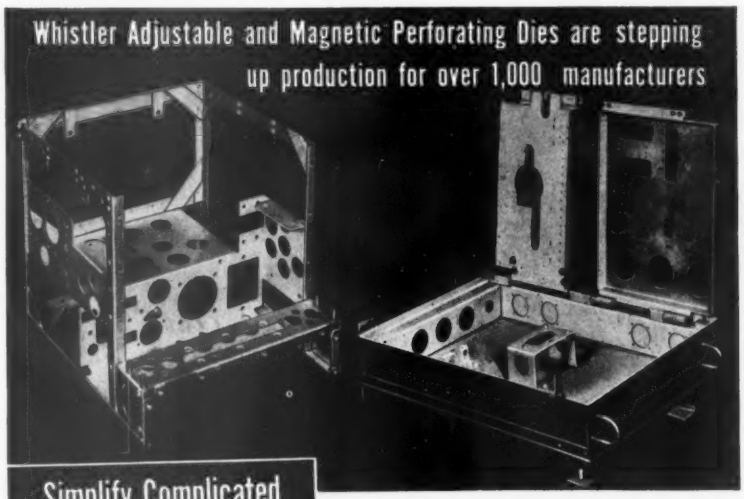
Complete Instructions on Soldering, Brazing, and Welding Aluminum Alloys are condensed into a small envelope enclosure size in a new folder from All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y. Anyone having to join aluminum to aluminum or aluminum to dissimilar metals such as copper, nichrome, stainless steel and the like should get his copy now.
Circle Inform-A-Gram No. B28.

Stamping Presses are described in a new 16 pager from Verson Allsteel Press Co., 9335 S. Kenwood Ave., Chicago 19, Ill. Condensed specifications are given for standard mechanical and hydraulic presses and press brakes, also data on special machines.
Circle Inform-A-Gram No. B29.

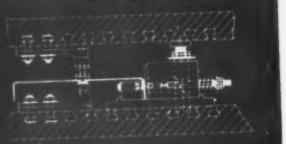
Comprehensive Washer Information is contained in an eight page three color booklet from the Detrex Corp., Box 501, Detroit 32, Mich. Profuse illustrations, operating hints, and technical data are given.
Circle Inform-A-Gram No. B30.

Collets, Live Centers and Drawbars are typical of the line of machine attachments described in current literature by General Die & Stamping Co., 264 Mott St., New York 12, N. Y. All products manufactured to exacting specifications for accuracy, fit and long life.
Circle Inform-A-Gram No. B31.

Complete Line of Hyraulic Bulldozers for hot and cold bending and forming operations by the Lake Erie Engineering Corp., Buffalo 17, N. Y. is described in one of the company's latest bulletins. Specifications, features, pictures.
Circle Inform-A-Gram No. B32.



Simplify Complicated Piercing Operations



Use this HU-50 90° Perforating Unit on the same job with other Whistler Dies . . . often saves extra press operations.

USE WHISTLER Adjustable and Magnetic Dies for perforating, notching and slotting sheet metals... fast, accurate and cost cutting. Complicated patterns can be set up quickly. Hole arrangements can be changed in the press... without waiting and at no extra die cost. New HU-50 units, that pierce at 90° angle, can be used in conjunction with standard perforating equipment. Fewer press operations are necessary.

Re-use the same dies in different arrangements on many jobs. Punches and dies are interchangeable.

Whistler Adjustable Dies can be used in practically every type press. Standard sizes and shapes of punches and dies available up to 3 inches. Special sizes and shapes to order.

S. B. WHISTLER & SONS, Inc.

748 Military Road
Buffalo 23, New York

For prices and application data on this modern way to speed production and cut unit costs, write for these illustrated Whistler catalogs.

For your convenience **Whistler direct factory representatives are located in most principal cities. Their on-the-job application experience, combined with Whistler's 35 years experience in the manufacture of tools and dies, is available on request.**

Comprehensive Cutting Tools Catalog, including taps, dies, twist drills, counterbores, keyway broaches and tap and die kits, has just been readied for distribution by Threadwell Tap & Die Co., Greenfield, Mass. Constitutes a complete buyer's guide.
Circle Inform-A-Gram No. B33.

Solvent Pumped Through Handle of a fountain brush is the secret of the efficiency of the low-cost "Brush-Flush" unit by Graymills Corp., 3713 Lincoln Ave., Chicago 13, Ill. This parts cleaning equipment is suitable for maintenance tool and die work and many production jobs. New bulletin available.
Circle Inform-A-Gram No. B34.

New and Radically Different Cut-Off Tool has just been announced by the Cir-Cut Div., New Britain Machine Co., New Britain, Conn. A folder has been readied for distribution with full data on the new development, which will substitute for straight blade holder without change in most screw machines of 1¾" capacity. Numerous advantages justified, claimed.
Circle Inform-A-Gram No. B35.

Perform Many Operations on One Machine. New bulletin from Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, Ohio, gives data on a range of machines which typically combine twelve or more operations in one unit. In-line transfer machines, cylinder block milling machines, weight balance milling machines, and multislide automatic turning machines are all included. Conserve floor space, part handling, set-up and labor time.
Circle Inform-A-Gram No. B36.

Lincoln Floor Cleaning and Maintenance Methods can reduce your upkeep costs as much as 75%. Basic equipment of the most effective and up-to-date nature is described in a bulletin from Lincoln-Schlueter Floor Machinery Co., 1250 W. Van Buren St., Chicago 7, Ill. Company offers expert survey of your floors, equipment and methods free.
Circle Inform-A-Gram No. B37.

"Bondycop" Hydraulic Copying Attachment is adaptable to any lathe, uses either first piece of batch or a jig as pattern. Operator controls only one measurement, angles of 90° in the direction of the headstock may be copied. Complete data, performance details given in catalog 537 from Morey Machinery Co., Inc., 410 Broome St., New York 13.
Circle Inform-A-Gram No. B38.

Entire Line of Keller Power Hack Saws are described in bulletin 1052 by Sales Service Machine Tool Co., 2363 University Ave., St. Paul 14, Minn. Two new models are specially featured, Nos. 4 and 5 "Hy-Duty" which have capacities of 7" x 7" and 9" x 9" respectively, together with variable pressure feed control for correct selection of feed/speed ratio for different materials. The line now comprises ten models, meets almost any requirement.
Circle Inform-A-Gram No. B39.

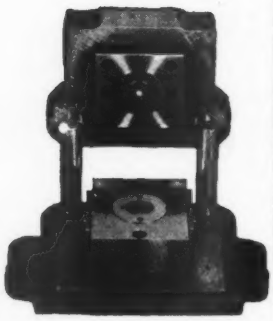
Ingersoll Cutter Grinding Manual 58H is now available to readers. Features of the machine described with all pertinent data include cutter location on grinder identical to that on the milling machine for more accurate results, and design which permits grinding face, periphery and corners of cutter in a single setting for maximum speed. From the Ingersoll Milling Machine Co., Rockford, Ill.
Circle Inform-A-Gram No. B40.

"A MUST wherever WASHERS are made!"

HOVIS

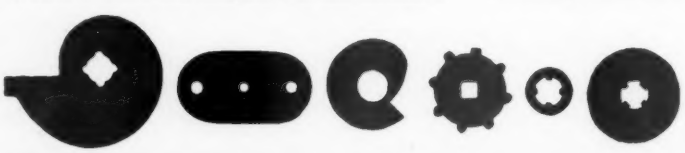
OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:
¾"—1½"—2½"—4"—6"

Write for literature.



HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD Phone: Slocum 7-4800
VAN DYKE, MICHIGAN Suburb of Detroit

New Line of Unbrako Button Head Socket Screws is featured in a bulletin which has just come off the press for Standard Pressed Steel Co., Box No. 600, Jenkintown, Pa. Many applications and listing of the seven standard diameters available are listed. Advantages of the design include threading to head, low head height, concentricity of heads and threads, and class 3 fit.
Circle Inform-A-Gram No. B41.

Niagara 6" Series All Steel Bending Rolls are given detailed coverage in bulletin 88-A from Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y. All rolls are pinch type and all are power driven. Engineered features permit forming rolls in one pass, while all machine controls are centrally located for maximum speed and convenience. Bulletin has all data and specifications, is amply illustrated.
Circle Inform-A-Gram No. B42.

Detailed Instrumentation Information, also data on tools and accessories for universal testing machines is given in catalog No. 46, just published by the Tinius Olsen Testing Machine Co., 1140 Easton Rd., Willow Grove, Pa. Electronic recorders; electronic strain instrumentation; tension compression, mechanical extensometers; tension compression and control accessories are only a few of the topics covered.
Circle Inform-A-Gram No. B43.

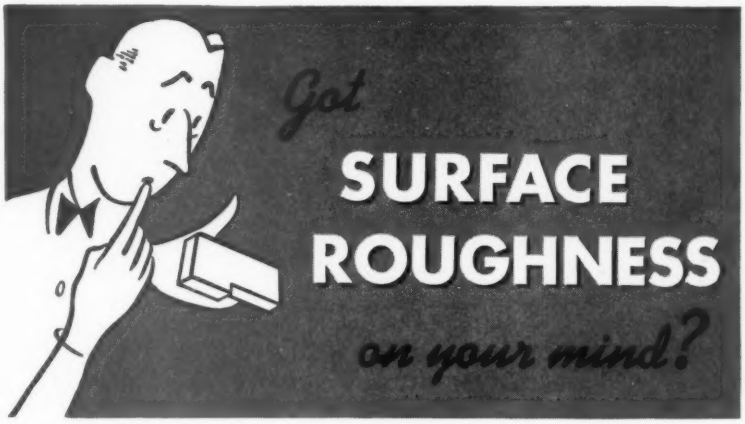
New Smith & Mills Shaper Catalog. Complete descriptions and illustrations of design features, plus specifications and attachment and accessories details on the line of standard, heavy duty and bench type shapers from The Smith & Mills Co., 400 W. Madison St., Chicago 6, Ill. Features of the line include solid ram with positive locking device, easy adjustment for length of stroke.
Circle Inform-A-Gram No. B44.

Improved Design for its 2 spindle, 20" swing model MC-20 drilling machine is announced in catalog 70 by Sibley Machine & Foundry Corp., South Bend, Ind. New features include sturdier column and base for best utilization of capacity of 1¼" in mild steel, spring-loaded spindle speed change and dial indicator selection of power feed. Good sensitivity for small work.
Circle Inform-A-Gram No. B45.

Price Information on all polishing supplies and standard equipment distributed by Wagner Bros. Inc., 434 Midland Ave., Detroit 3, Mich., plus news of recent developments in the plating industry, is contained in the new house organ "Wagner Price-Tips," the first issue of which is now available.
Circle Inform-A-Gram No. B46.

A Two-Page Bulletin describing the new model 876 'Sine-Line' hob and worm lead checker and the model 464 'Sine-Line' hob contour checker is now available from Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. In addition to complete description, an illustration of each machine is given with specifications.
Circle Inform-A-Gram No. B47.

Universal Self-Levelling Clamps by the DoALL Company, Des Plaines, Ill., are described in bulletin 51-809 and are adaptable to any kind of work holding problem. No shims, pads, or stepblocks. Full data, ordering information, etc., contained in literature.
Circle Inform-A-Gram No. B48.



Then you'll want FREE BULLETIN L21. It tells . .

- **How to establish roughness specifications**
  — for parts in production, and
  — for parts of new design.
- **How to show roughness specifications** on working drawings and shop prints.
- **Practical benefits** gained by specifying surface roughness.

This bulletin also defines "surface roughness." It gives practical pointers on MEASURING surface roughness in the shop — and briefly tells why most plants use the PROFILOMETER for doing this.

Write today for your free copy. Ask for *Bulletin L21.*

Profilometer is a registered trade name.

MMCo
MICROMETRICAL
MANUFACTURING COMPANY
345 S. MAIN ST. ANN ARBOR 15, MICHIGAN

Collet Chuck Catalog from Sutton Tool Co., Sturgis, Mich., has useful data and information of the company line. Features include pressure adjusting ring with ball detent lock, positive cam closing collar, three hardened cam levers and parallel grip design collet.
Circle Inform-A-Gram No. B49.

"Metal Spinning Tools and Their Use" is title of a new booklet just published by the Boice-Crane Co., 963 Central Ave., Toledo 6, Ohio. Contains procedure information, tool and equipment data, is now available to readers.
Circle Inform-A-Gram No. B50.

New Dockboard Bulletin Issued. Light weight heavy duty magnesium dockboards speed loading and unloading on the shipping dock, give complete safety. Bulletin from Magnesium Co. of America, East Chicago, Ind., gives complete data in four colorful, easy-to-read pages.
Circle Inform-A-Gram No. B51.

Cast Aluminum Line of Unmachined Controls is described in bulletin TP-10 from Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, Ohio. Hand wheels, straight or angled, with or without lugs; offset handle speed handles and clamping levers, etc.
Circle Inform-A-Gram No. B52.

EXAMINE *It Closely*

THERE IS A DIFFERENCE

Model J, 10" x 18" capacity. Available as a wet or dry cutting machine.

JOHNSON METAL CUT-OFF BAND-SAWS

Have Outstanding Features

If you are thinking about new metal-cutting equipment, it will pay you to investigate the outstanding features of the Johnson Metal-Cutting Saws. Their exclusive design, ample capacity and ruggedness speak for themselves. These efficient low-cost machines offer the highest value available today.

Write for Details Today

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

"Molykote Centerlube" is a recently developed molybdenum base lubricant with particular application advantages beyond the capacity and temperature range of conventional lubricants. A four page folder from the Alpha Corp., 179 Hamilton Ave., Greenwich, Conn., stimulates thought on how you can cut costs on downtime and repair.
Circle Inform-A-Gram No. B53.

Production Facilities For Contract, including automatic screw machines, turret lathes, inspection equipment, etc., of Stryker Machine Products Co., 253 John Fitch Way, Trenton, N. J., are described in a new folder now available to readers. The company is able to process any job from raw material to completed part, including heat-treat, welding, grinding, and plating.
Circle Inform-A-Gram No. B54.

There are 32 Pages of Carbide Alloys Information in the latest brochure from the Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa. Production techniques; applications; general info on grades for machining different materials and for punches, dies, and wear parts are featured together with lists and use methods of available blanks, tools, die sections, punches and drawing die inserts. Get your copy now.
Circle Inform-A-Gram No. B55.

Booklet "A New Concept In Grinding Wheels" from Cincinnati Milling Machine Co., Cincinnati 9, Ohio contains a wealth of valuable information from the research labs of the company. In this important new booklet is presented a complete picture story of every step of the wheel manufacturing process. Many remarkable and startling microphotographs. If you've got a grinder, you should also have a copy of this bulletin.
Circle Inform-A-Gram No. B56.

An Abrasive Belt Method of Micro-Finishing Carbide Turning Tools has just been jointly announced by Fenlind Engineering Co., of Rockford, Ill., and Behr-Manning Corp., of Troy N. Y. The complete story is told in a new folder from Behr-Manning. Simple equipment not only eliminates the necessity for diamond wheels, but gives many other all-round cost economies—and—increases tool efficiency and cutting life in many operations.
Circle Inform-A-Gram No. B57.

Modern 4-Way Drilling, Boring, and Facing Machine for aircraft jet engine housings is described in new bulletin #103-34 from the Modern Industrial Engineering Co., 14230 Birwood, Detroit 4, Mich. Included in the bulletin are a photo of the machine, complete operating description and specifications.
Circle Inform-A-Gram No. B58.

November 'Grits and Grinds' from the Norton Company, Worcester 6, Mass., features as major subject modern techniques in barrel finishing, also has shorts on causes and cures of failure to keep work straight during grinding, and on interesting machines for precision thickness grinding of wide web sheets in various materials.
Circle Inform-A-Gram No. B59.

52 Page Book of Drawings, Specifications and Prices of standard jig and fixture parts by Noble & Stanton, Inc., 1002 Broadway, Bedford, Ohio, is now available to readers. All parts turned from solid stock, heat-treated and hard-chrome plated where practicable. Tracing sheets save time in your design department.
Circle Inform-A-Gram No. B60.

Flame Plating Process for tungsten carbide coating wear parts is described in new brochure from Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y. 2 micro-inch finishes readily obtainable, hardness 89.3 Rockwell A. A wide range of part sizes and shapes may be treated, and other coatings used.
Circle Inform-A-Gram No. B61.

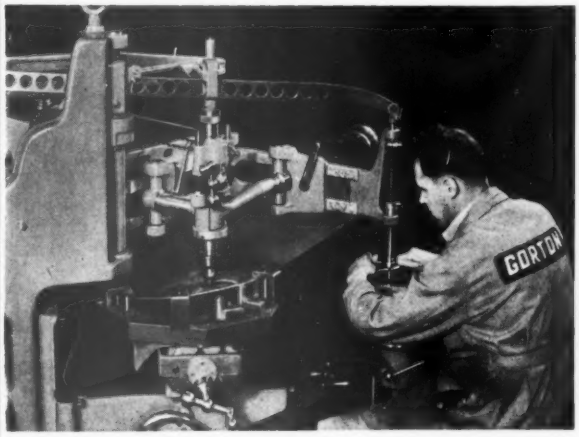
"Work Done on the Blanchard" is title of profusely illustrated booklet from the Blanchard Machine Co., 64 State St., Cambridge, Mass. Contains 83 pages; gives representative and graphic picture of just what is possible with the Blanchard technique. Hard bound, pocket size.
Circle Inform-A-Gram No. B62.

Barker Bench Miller, ideal for handling small-run precision jobs, is subject of new circular giving complete data on machine performance and describing the various precision operations which can be performed thanks to the machine's versatility. Exclusive 3-way hand-lever travel, ample speed and rigidity for carbide cutters. Your copy from Barker Eng'g. Co., 500 Green Rd., Cleveland 21, Ohio.
Circle Inform-A-Gram No. B63.

Lappers for External Gears are featured in new bulletin 993-5 from Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. Descriptions and specifications for machines for lap mating two gears together, one gear with two laps, or two gears on a cluster with one lap each. Use Inform-A-Gram Card to get your copy.
Circle Inform-A-Gram No. B64.

Care and Operation of Automatic Rivet Setting Equipment is subject of a brochure now available to readers from Milford Rivet & Machine Co., Boston Post Rd., Milford, Conn. Special section given to operation and maintenance of the Horton Clutch. Save on breakdown time, see how to set-up preventative maintenance, apply for your copy today.
Circle Inform-A-Gram No. B65.

Cooper Weymouth Slide Feed No. 4060 is new and improved slide feed for automatic punch press operation. Features include new check roller release for faster, easier setting up, positive one way clutch, carbide tipped adjustable feed table, double feed block stops. A catalog with all data and specifications is now available from Cooper Weymouth, Inc., 277 Noble Ave., Bridgeport.
Circle Inform-A-Gram No. B66.



Tracer-Controlled Pantograph cuts and rounds thermal slot in 8-foot steel propeller blade in 40 minutes; previous time was 5 hours, 10 minutes — just one of hundreds of examples of time and cost saving with tracer-controlled Pantograph machines.

Pantography IS NEW —

— in the sense that industry at large and Metal Working people in particular are just beginning to appreciate the many advantages Pantography offers to those faced with the Design-Production problems of today and tomorrow.

By George Gorton III
Executive Vice President
George Gorton Machine Co.

INDUSTRY'S foremost responsibility right now is to produce faster, to highest quality standards and at lower cost — whether on defense contracts or for our civilian needs.

Today, there are literally thousands of operations being performed throughout industry which can be speeded up, improved in quality and lowered in cost by the use of available models of special machine tools. The modern tracer-controlled Pantograph machine is such a tool. It is both a special purpose machine, ideal for short runs, and it is an accurate single purpose machine which turns out identical parts or pieces to meet tight production schedules.

The tracer-controlled Pantograph machine is used for inside and outside profiling, routing, die sinking, mold cutting, counterboring, contour milling, chamfering, grooving, graduating and engraving in ferrous and non-ferrous metals, as well as in plastics.

This machine performs on flat, uniformly curved, cylindrical, spherical or irregular shapes — it works in either 2 or 3 dimensions, in all directions on a horizontal plane, and vertically. It employs enlarged masters, templates or patterns which are quickly and easily made and operates normally at a reduction ratio thereby increasing accuracy — exclusively characteristic of the pantograph.

Single or repetitive accuracy — from one piece to thousands — manual or full automatic operation depending upon quantities — work sizes from the size of a dime to as large as 10 feet.

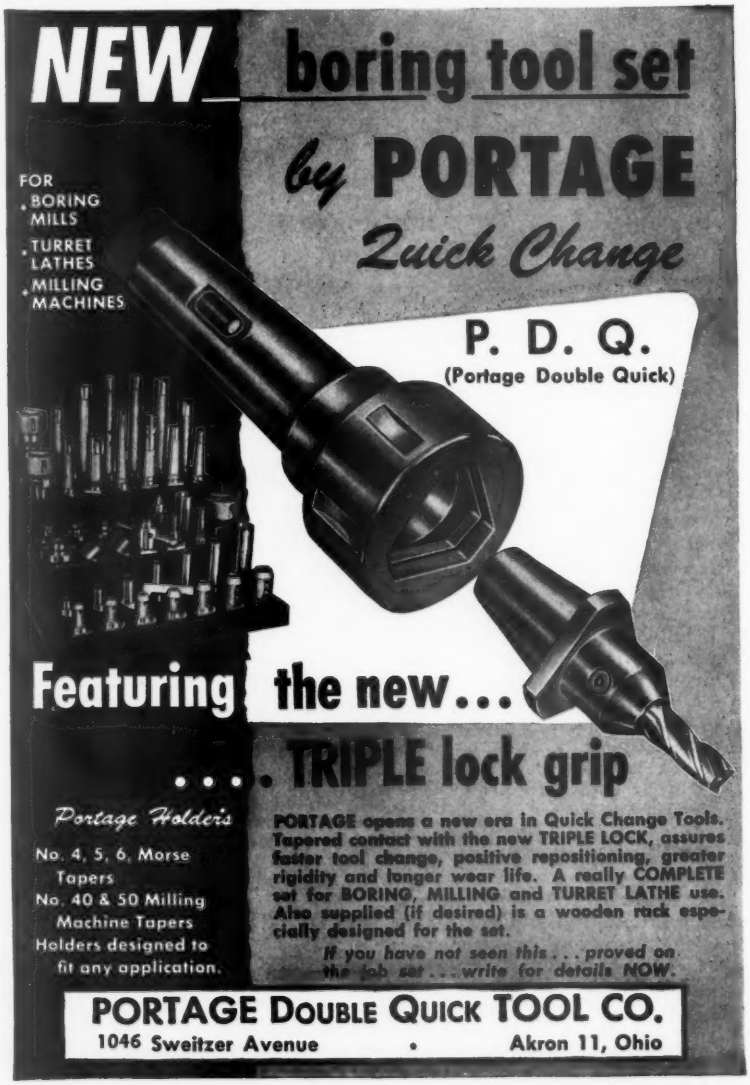
A new booklet, "Pantography," explains the process and shows what this type of machine can do for you. It is yours without obligation. Write for it today. If interested, also ask for our latest General Catalog 1655. Address the George Gorton Machine Co., 1201 Racine St., Racine, Wisconsin, U. S. A.

Flexible Tubing Catalog Available. Tubing for ventilation, fume and dust removal, and materials handling is described in bulletin C2-4 from Flexible Tubing Corp., Guilford, Conn. Detailed specifications, air friction charts, data on oil and chemical resistance and application information are furnished for all types.
Circle Inform-A-Gram No. B67.

"Supersheen" Barrel Finishing Process and related equipment, together with a very useful section on proper application for best results on your finishing problem are discussed in a new 20 pager from Almco Division of Queen Stove Works, Inc., Albert Lea, Minn. No lower cost method of finishing metal parts!
Circle Inform-A-Gram No. B68.

"Patco" Steel Tubing and cold finished rods and bars are described in bulletin No. 10 just published by Pacific Tube Co., 5783 Smithway St., Los Angeles 22, Calif. Standard manufacturing tolerances and size ranges on a comprehensive product range are given, also physical properties of standard tubing analyses.
Circle Inform-A-Gram No. B69.

Pioneer Tool Gauge Block Jaw slashes inspection set-up time from 50 to 75%, greatly reduces wear and tear on the blocks. Complete use data and operation principle is given in a very convincing bulletin devoted to this functionally accurate and simple device. From the Pioneer Tool & Eng'g Co., 3914-18 W. Shakespeare Ave., Chicago 47, Ill.
Circle Inform-A-Gram No. B70.


NEW boring tool set
by PORTAGE
Quick Change
FOR
• BORING MILLS
• TURRET LATHES
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P. D. Q.
(Portage Double Quick)
Featuring the new...
....TRIPLE lock grip
Portage Holders
No. 4, 5, 6, Morse Tapers
No. 40 & 50 Milling Machine Tapers
Holders designed to fit any application.
PORTAGE opens a new era in Quick Change Tools. Tapered contact with the new TRIPLE LOCK, assures faster tool change, positive repositioning, greater rigidity and longer wear life. A really COMPLETE set for BORING, MILLING and TURRET LATHE use. Also supplied (if desired) is a wooden rack especially designed for the set.
If you have not seen this . . . proved on the job set . . . write for details NOW.
PORTAGE DOUBLE QUICK TOOL CO.
1046 Sweitzer Avenue • Akron 11, Ohio

Hallowell Steel Shop Equipment described in new bulletin 839 from the Standard Pressed Steel Co., Box 600, Jenkintown, Pa. Included are work benches; cabinet and multiple unit benches; portable cabinets; tool carriers and drawer tier units. Material color, dimensions, and shipping weight are given.
Circle Inform-A-Gram No. B71.

Filtering Systems for coolants and cutting oils are described in the latest bulletin from Wm. W. Nugent & Co., Inc., 410 N. Hermitage Ave., Chicago 22, Ill. Included are pressure type filters and gravity systems which both protect tools and extend the useful life of coolants and cutting oils.
Circle Inform-A-Gram No. B72.

Stock-List—Calculator to Speed Price Figuring on stainless steel requirements and at the same time to keep your stock list current has been developed by the Chicago Steel Service Co., P.O. Box 6308, Chicago 80, Ill. Big time and trouble saver for users of stainless steels.
Circle Inform-A-Gram No. B73.

Meyco Carbide Inserted Bushings have tungsten carbide rings at wear points, with special steel ring backing to protect both insert and drill. Cost approximates to that of ordinary steel bushings, working life to that of solid carbide. Full data and range details in bulletin 17 from W. F. Meyers Co., Inc., Bedford, Ind.
Circle Inform-A-Gram No. B74.

New Large Sizes Seamless Light-Wall Tubing. The Superior Tube Co., 1560 Germantown Ave., Norristown, Pa., has just announced an increase in the size range from 1¼" OD max. to 2-1/16" OD max. The tubing is furnished in three stainless analyses and in Monel* metal. Full information on the complete range may now be had from the manufacturer.
Circle Inform-A-Gram No. B75.

Clearing Forging Presses are described in new bulletin No. 217 from the Clearing Machine Corp., 6499 West 65th St., Chicago 38. Features include super-grid construction, offset eccentric, quick acting air clutch and air disc brake, and accurate screw/wedge operated die adjustment. Complete specifications for the line of ten machines are given.
Circle Inform-A-Gram No. B76.

Handy Data Sheets on Punches and Die Buttons completely cover both specifications and prices of the entire products line of Ring Punch & Die Company, 108 Foote Ave., Jamestown, N. Y. Punches are precision made of both carbon vanadium and high carbon, high chrome steels, button dies in either ring or press fit types.
Circle Inform-A-Gram No. B77.

V-Belt Drive for South Bend Lathes is featured in bulletin 5231 from the South Bend Lathe Works, 425 E. Madison St., South Bend 22, Ind. Especially suitable for work requiring heavy cuts at slow and medium spindle speeds. The bulletin also has interesting information on the line of bench lathes and accessories.
Circle Inform-A-Gram No. B78.

Catalog Describes Single Point Carbide Tools and carbide tips and blanks. This production, No. 52-817, has just come off the presses for the DoALL Co., Des Plaines, Ill. Contains grade and comparison charts, full ordering information, data on chip control grooves, etc.
Circle Inform-A-Gram No. B79.

Air Presses; Arbor Presses; Band Saws; Drill Presses; Foot Presses; Power Presses and Squaring Shears are all described in the new catalog from Famco Machine Co., Kenosha, Wis. This catalog of "Cost-Cutting Machines" is fully illustrated, with full treatment of all specifications and machine features.
Circle Inform-A-Gram No. B80.

120 Pages of Cutting Tool Information. Latest catalog offered by the Gorham Tool Co., 14415 Woodrow Wilson, Detroit 3, Mich., has exhaustive listing of standard and special tools of all types, from end mills to rotary shears. Packed with useful cutting tool information—plus a valuable section of Engineering Data. You should have a copy of this book.
Circle Inform-A-Gram No. B81.

Press Room Output can often be multiplied five times by the simple addition of Littell Automatic Feeds to present equipment. Types within the standard line serve all classes and sizes of presses, handle all standard widths and thicknesses of stock. Rack and pinion drive combines smoothness and gradual acceleration and deceleration. F. J. Littel Machine Co., 4197 N. Ravenswood Ave., Chicago 13, Ill.
Circle Inform-A-Gram No. B82.

Lathe Mounting Bulletin. Illustrates method for mounting lathes and dampening vibration without drilling or lagging into the floor. Complete use instructions on Unisorb mounting pads and cement. Copies of this vibration control booklet from The Felters Co., 210 South St., Boston 11, Mass.
Circle Inform-A-Gram No. B83.

Specimen Preparation Equipment for the metallurgical lab. is described in the latest catalog from Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Ill. The line includes cut-off machines; specimen mount presses; power grinders; emery paper grinders; hand grinders; belt surfacers; mechanical and electro polishers; polishing cloths and abrasives.
Circle Inform-A-Gram No. B84.

Hydraulic Power Units Individually Designed to give the utmost convenience in installation and performance in operation feature the Vickers "sandwich" panel construction which saves space, results in a more compact, cleaner panel valve and simplifies maintenance. From Vickers, Inc., 1450 Oakman Blvd., Detroit 32.
Circle Inform-A-Gram No. B85.

Bench Model Metal Cut-Off Saw is described in a catalog sheet from the Crowningshield-Harris Co., Country Club Rd., Greenfield, Mass. Vice capacity to 5½" x 7", speeds 100 and 135 fpm., feed gravity controlled, instantly adjustable. The saw weighs only 112 lbs. complete with motor for maximum portability.
Circle Inform-A-Gram No. B86.

SANFORD BENCH SURFACE GRINDER
MODEL SG

for Wet or Dry Grinding!*

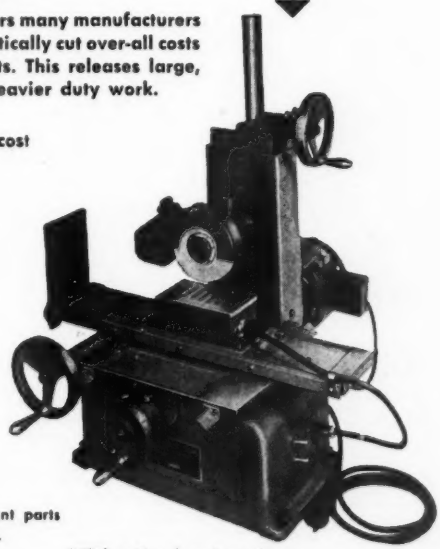
PRECISION • SPEED • SENSITIVITY

A *low cost*, precision machine for surface grinding dies, instrument parts, gauges and other small parts which would fit in the palm of the hand.

By using Sanford Bench Grinders many manufacturers of precision machinery have drastically cut over-all costs for finishing small intricate parts. This releases large, more expensive machines for heavier duty work.

The Sanford SG is the *only* low cost Bench Surface Grinder that

- **Grinds to less than .0001" tolerances**
- **Operates without vibration**
- **Assures long life because Meehanite castings are used in its construction**



SPECIFICATIONS—4" traverse —8" longitudinal—6" vertical under 4" wheel. Approximate weight 160 lbs.

Complete details are included in illustrated bulletin.
Send for your copy today.

Reconditioning facilities, replacement parts and special attachments are available.
Send for price list.

**With optional equipment*

SANFORD MANUFACTURING CORP.
1024 Commerce Ave., Union, N. J.

Maxwell Boring Tools feature high speed operation, adjustment to .0001" and maximum boring range. The E Z Set tools are available in three models having maximum capacities of ½", 1", and 1½", and covering a boring range of ⅜" to 20". Interchangeable shanks permit use in turret lathes, jig borers, milling machines and boring mills, etc. Catalog now ready. The Maxwell Co., 250 Broadway, Bedford, Ohio.
Circle Inform-A-Gram No. B87.

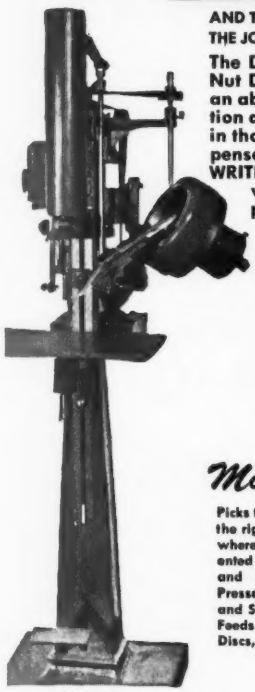
Denison Multipress has smooth oil-hydraulic power and control, offers complete adjustability of ram speed, pressure, and stroke length. Denison Engineering Co., 1197 Dublin Rd., Columbus 16, Ohio, now has for distribution a series of 'Data Logs' on all conceivable types of pressing operations, from crimping through blanking and forming to staking and stamping. A complete range of attachments is now available for this very versatile machine.
Circle Inform-A-Gram No. B88.

2KW High Frequency Induction Heating Unit by Lepel High Frequency Laboratories, Inc., 55th St., & 37th Ave., Woodside 77, New York City, is low cost and portable, is designed to meet the needs of machine shops, toolrooms, research labs and educational institutions. No mounting is necessary. The unit is especially suitable for hardening, brazing and soldering small parts of either ferrous or nonferrous metals.
Circle Inform-A-Gram No. B89.

It's PRODUCTION Today
Speed! More Speed! Is the Call—

AND THESE MODERN POWER-DRIVEN ASSEMBLING MACHINES WILL DO THE JOB FOR YOU AT A REMARKABLE TIME AND LABOR-SAVING PACE

The D.P.S. line of Power Screwdrivers, Motorized Hoppers, Nut Drivers and other power-driven equipment has proved an absolute necessity in the present-day program of production assembling. In replacing slow, expensive hand methods in thousands of plants, they are now intrenched as an indispensable aid in meeting urgent calendar requirements—WRITE US, send sample assembly, receive our catalog, and we shall gladly offer suggestions so that you, too, may profit by the use of D.P.S. equipment.



Model B

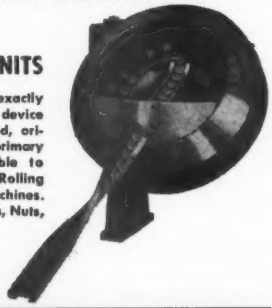
DPS POWER SCREWDRIVERS
DRIVE SCREWS AS FAST AS ONE A SECOND

All types of screws: Machine screws, sheet metal screws, self-tapping screws, with standard round, flat, binder, fillister or hex heads and special heads. No marring of heads or stripping threads; all screws driven to uniform tension. Hopper fed, SCREWS ALWAYS IN SIGHT OF OPERATOR. 3 models.

Motorized HOPPER UNITS

Picks them up and lays them down in exactly the right position—A selective feeding device whereby production parts are selected, oriented and fed in a given position for primary and secondary operations. Adaptable to Presses, Centerless Grinders, Thread Rolling and Slotting Machines and Special Machines. Feeds Screws, Screw Blanks, Rivets, Pins, Nuts, Discs, Washers, Steel Balls, etc.

6 sizes, 8", 10", 12", 16", 24" and 30" diameters



DETROIT POWER SCREWDRIVER CO.
2827 W. FORT ST. DETROIT 16, MICH.

American Drill Jig Bushings are comprehensively covered in a new catalog from American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif. The bushings line is stated to be the largest selection of standard types and sizes available, with all lengths standard. The catalog is clearly organized and printed for your maximum convenience, has handy reference charts, pricing, and technical data, and is plastic coated to resist soiling.
Circle Inform-A-Gram No. B90.

Features of the Boye' & Emmes Engine Lathe are discussed in bulletin No. 603 which has just become available to you from the Boye' & Emmes Machine Tool Co., 133 Caldwell Dr., Cincinnati 16, Ohio. Special "back-gear-in-front" feature protects spindle bearings permanently during heavy cuts, assures maximum life and accuracy under the most demanding working conditions.
Circle Inform-A-Gram No. B91.

Brochure "This Carbide Age", from Wesson Metal Corporation, Lexington, Ky., constitutes an interesting study of carbide developments and present-day applications in the cutting tool field. Wessonmetal carbide tools are fully featured.
Circle Inform-A-Gram No. B92.

Universal Index Plungers greatly simplify jig and fixture construction since plunger body and bushing have same diameter, all holes can be bored with the same tool, often in the same setting. Full data on straight and taper types in a standard size range is obtainable from Universal Engineering Co., Frankenmuth 8, Mich.
Circle Inform-A-Gram No. B93.

Complicated Piercing Operations are simplified, die costs cut and production increased with adjustable and magnetic perforating dies from S. B. Whistler & Sons, Inc., 748 Military Rd., Buffalo 23, N. Y. Complicated patterns quickly set up, hole arrangements changed in the press without waiting and with no extra die cost. New HU-50 units, that pierce at a 50° angle, can be used in conjunction with standard perforating equipment. The same dies can be re-used in different arrangements on many jobs, and punches and dies are interchangeable. Detailed illustrated literature is now available.
Circle Inform-A-Gram No. B95.

SG Bench Surface Grinder by Sanford Mfg. Corp., 1024 Commerce Ave., Union, N. J., combines accuracy to better than .0001" tolerances with a low first cost and vibrationless long life. Can be equipped for wet or dry grinding. Specifications summary: 4" traverse; 8" longitudinal; 6" vertical under four inch wheel. Ideal for precision grinding dies, instrument parts, gauges, etc.

Circle Inform-A-Gram No. B96.

Wittek Roll Feeds handle any type of coiled strip stock and are made in single, double roll and compound types with straighteners, in models to feed in any of four directions. Simple and speedy adjustment of feed length. Standard sizes and models meet a wide variety of press size and capacity conditions. Descriptive literature with all details and specifications now available from Wittek Mfg. Co., 4323 W. 24th Place, Chicago 23.

Circle Inform-A-Gram No. B97.

Fray 10-R Universal Miller will machine at any angle, mill, drill, or bore. Changeover is quickly and easily made, so that on any single piece of precision work requiring a variety of operations it is easier to reset the machine than to transfer the work. Universal ram turret type vertical and horizontal machine. Full data and specifications are contained in informative bulletin No. 10 now ready. Fray Machine Tool Co., 515 West Windsor Rd., Glendale 4, Calif.

Circle Inform-A-Gram No. B98.

Sturtevant Torque Wrenches read by sight, sound or feel, are made in a complete line of capacities from 0.6000 ft. lbs. Features include permanent accuracy; near indestructibility; automatic release; speed and ease of use. When the pre-set torque is reached, the sensory mechanism clicks distinctly, at the same time imparting a definite strong impulse to the hand. Torque is also read off from dials. Manual from P. A. Sturtevant Co., Addison, Ill., has all data.

Circle Inform-A-Gram No. B99.

Style JS 'Empco' Jack is new machine leveling device developed by the Enterprise Machine Parts Corp., 2735 Jerome Ave., Detroit 12, Mich. The jack is tested to support 20 tons and lift 8,000 lbs, comes in three minimum height sizes between 1¾" and 3". The jack locates on an anchor bolt, self-aligns to uneven floor, and a simple turn of the adjusting nut raises or lowers the machine.

Circle Inform-A-Gram No. B100.

Horberg Precision Taper Pin Gages save time and materials in such applications as checking hole sizes and locations, finding centers and gaging slots, etc. Oil-hardened tool steel ground to an accuracy of + .0001" — .0000". Full data on the complete size and kit range is available from Horberg Gage Co., 29 Staples St., Bridgeport, Conn.

Circle Inform-A-Gram No. B101.

"SupeReamers" in 470 Stock Sizes with variations of .001" are carried by the Twentieth Century Mfg. Co., 3720 Montrose Ave., Chicago 18, Ill. Throughout the line flutes are polished and ground and held to .0002" tolerances. Literature and prices from maker.

Circle Inform-A-Gram No. B102.

Formed Parts Trimming by friction sawing is a technique offering tremendous savings in time and money. Cuts are fast and smooth, and in most cases no jigs or rests are required. Soft steel or armorplate equally well handled. Brochure from Tannewitz Works, Grand Rapids, Mich., has complete process data.

Circle Inform-A-Gram No. B103.

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R. A. KENGOTT *President of Clinton Specialty Works, 2645 North Paulina, Chicago 14, Ill., whose company attests that "we are of the opinion that with a standardization on Pivot straightground whipsleeve punches any company could give better delivery service and parts by punching instead of drilling holes".*

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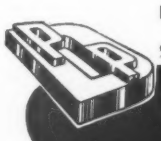

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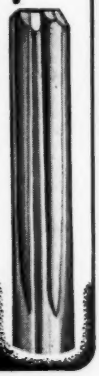
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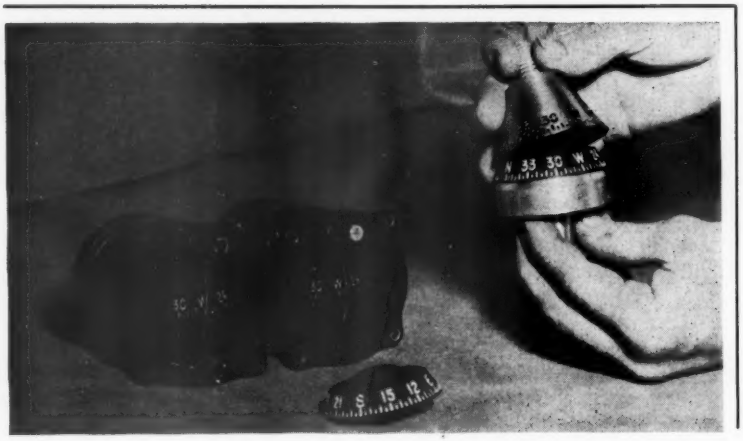

Spray Gun Lettering

Painting dials for B-16 type compasses has become a simple operation at Temco Aircraft Corporation's Overhaul Division at Greenville, Texas, with the development of a special stencil in the Temco-Dallas Engineering and Tooling departments.

The dial of the B-16 compass is in the form of a truncated cone with the degree marks on the side. Due to its shape, the dial does not lend itself to normal painting operations. Markings on such an instrument must be accurate, as the slightest error could result in faulty navigation. Painting the dials by hand, as was formerly done at TEMCO is a difficult and expensive operation.

Developed in the Temco Engineering department and constructed by skilled tooling department employees, the conical stencil makes painting the dials with a spray gun practical. The hollow cone stencil fits over the face of the dial, which is mounted on a swivel base. The stencil and dial are then rotated by means of a knurled knob at the apex of the stencil while the paint is sprayed on with an ordinary spray gun.

Use of the stencil has eliminated the necessity of tedius hand painting on the dials, and at the same time insures the accuracy of every dial painted.

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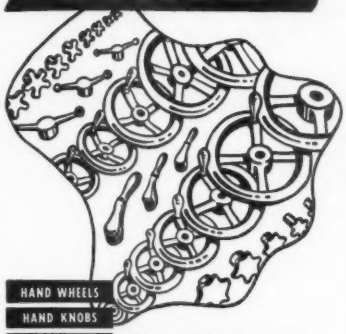

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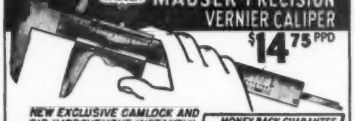

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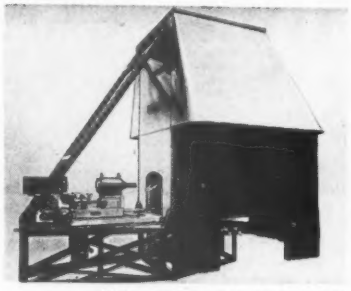

Photo courtesy Engis Equipment Co.

to 100 times magnification for work up to 3 inches diameter. For work up to 6 inches, 10 times magnification also is available.

The unit has found use in the automotive, aircraft, ball bearing and cutting tool industries. It is practically adapted to handle jet engine components and tools for jet engine manufacture.

Apprentice Draftsmen

A report entitled "Standards for Training Machine Tool Draftsmen" has just been published by the National Machine Tool Builders' Association. Prepared by the Association's Committee on Apprentice Training, it is presented as a supplement to the Association's report on "Apprentice Training Standards for Machinists", issued by the Association in 1949.

The new report includes a summary of standards for training machine tool draftsmen, and suggested forms of application for apprenticeship, apprenticeship agreement, conditions of apprenticeship, and quarterly apprentice report. It also contains a facsimile of a certificate issued upon completion of an accredited apprenticeship.

Copies of the booklet may be purchased from the National Machine Tool Builders' Association. 10525 Carnegie Ave., Cleveland 6, Ohio, at $1.50 each.

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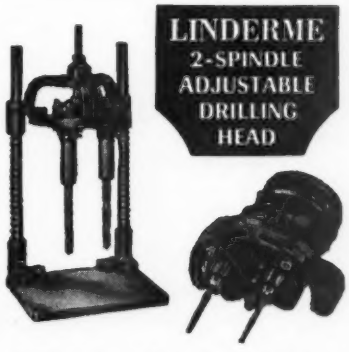

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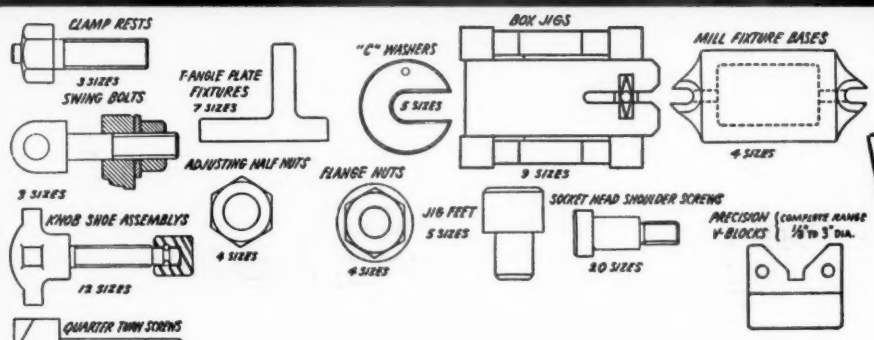

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7	21	35	77A	88A	94D	102B	103A	116A	122E	129B	132D	134E	137E	145B	153
8	22	36	77B	88B	94E	102C	103B	116B	122F	130A	132E	135A	138A	146A	154
9	23	37	78A	88C	95	102D	104	116C	123A	130B	132F	135B	138B	146B	
10	24	38	78B	89	96A	102E	105	117A	123B	130C	132G	135C	140A	147A	
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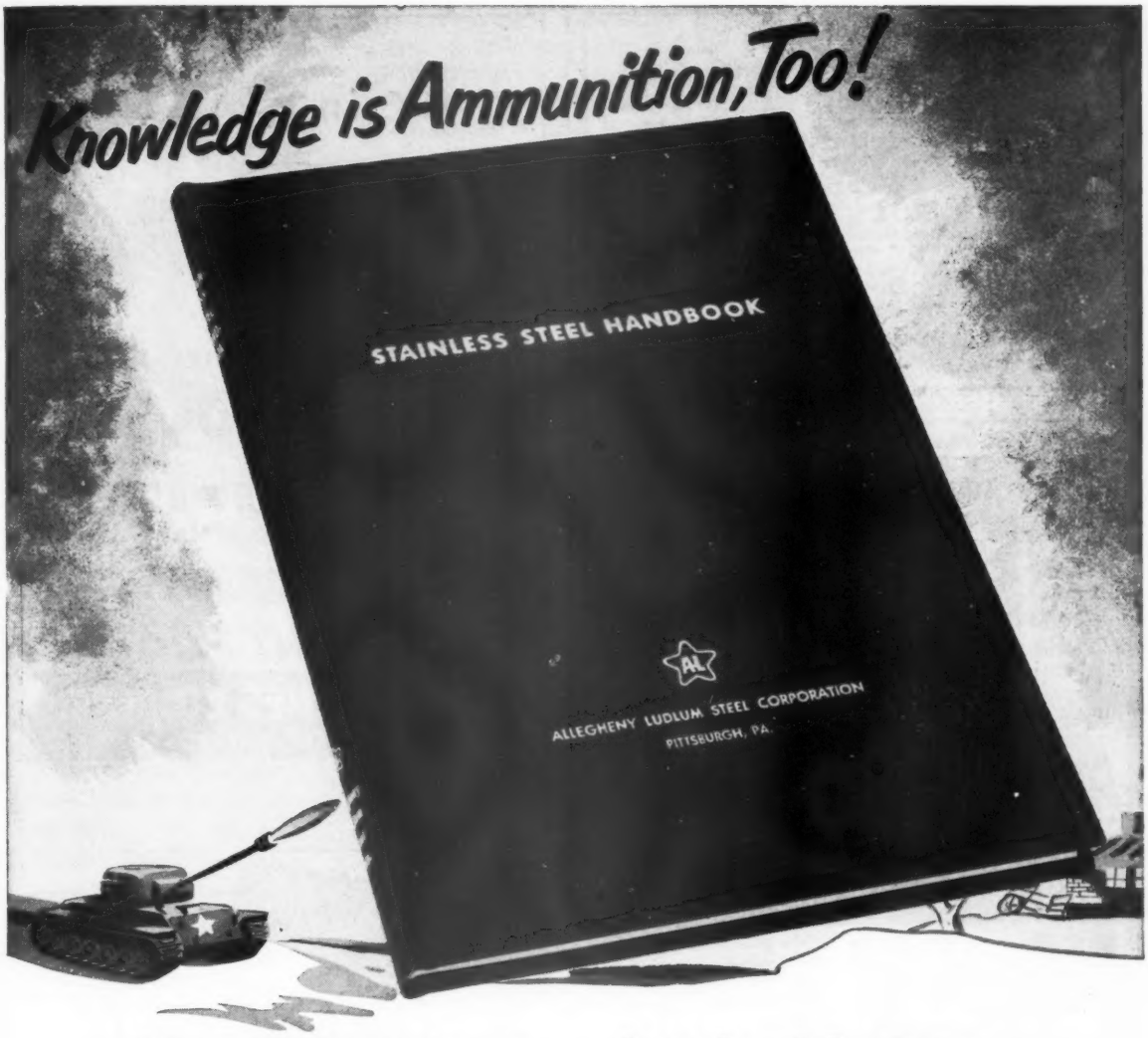

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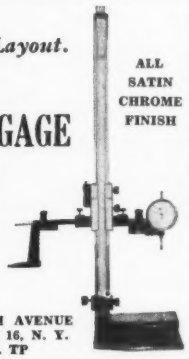

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. . . Cost Controls, from page 79

ment of a Continental Can Company plant. The first foreman we contacted recognized our system as one similar to a system he had worked with in another company. With but little coaxing and a minimum of explanation, he planned his operations in extremely careful fashion based on the facts in the reports. Within a period of two months this foreman had increased the output of his department from approximately 60% of capacity standard to 80% of capacity standard; a performance increase of 33%.

Top executives in both accounting and operating had difficulty believing the effectiveness of our program in this first department. Later experience proved that the result of effective planning and controlling of departmental expenditures cut cost and raised performance in every department in that plant. Furthermore, progressive reduction in excess costs over the budget continued for a period of six months.

Specifically, the following results were obtained in the above plant: with a total labor budget for productive and non-productive labor in June of $54,000 there was a 30% excess cost over this budget of $16,700. By

Continued page 130

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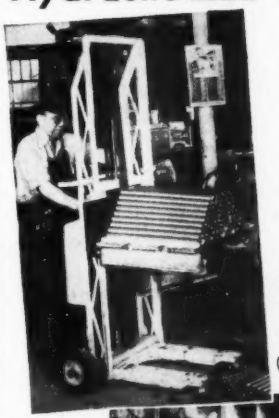

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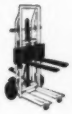

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NEW Portable Pitch Diameter Gage

Floating rolls assure true pitch diameter reading. Rolls are removable (to check wear) and are interchangeable for your diverse requirements.

checks pitch diameter of gears, splines or any other over-roll measurements.

Gives instantaneous, accurate reading of the pitch diameter with no effort on the part of the operator. Ideal for quality control. Available in sizes to check pitch diameters from 3/16" to 12" or larger.

We manufacture a complete line of gages such as Dial Bore Gages, Dial Snap Gages, Dial Groove Gages, Dial Groove Location Gages, Dial Shallow Hole Gages and all standard AGD Plug and Ring Gages.

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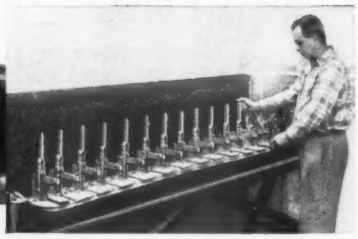

DESTACO HOLDS THE EDGE

Photos: Courtesy Holley Ski Co., Detroit, Michigan

Skiers know proper edging is most important for smooth slalom maneuvers. In production, precision tooling is necessary to obtain quality products. In the manufacturing of Plasti-Glass Skis the Holley Ski Company use De-Sta-Co's Model 620 Plunger Clamps to provide proper pressure during the slotting of the skis at a 22½ degree angle to allow for a patented moulded edge. Fifteen De-Sta-Co Model 110-C Toggle Clamps with Pressure-Matic adapters provide the necessary holding force to the welded angle plates which hold the ski in place during the cementing of the spring steel edges. Completely retractable the clamps allow easy insertion and removal of the skis from the drying fixture.

There's a De-Sta-Co Toggle Clamp engineered for your work-holding problems in assembly, welding, bonding, machining or inspection. Select from over 40 fixture and portable models. Positive holding pressures up to 4000 pounds. Write today for a copy of the De-Sta-Co catalog describing available stationary and portable toggle clamps.

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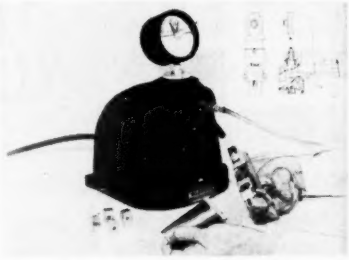
Gages for Inspecting Root Forms on Jet Blades

Two new gages that greatly speed the checking of external and internal pitch diameters of the root forms on jet engine blades and blade carriers have been recently developed. These to be used as hand gages in conjunction with a standard Air-O-Limit Comparator.



Photos courtesy Pratt & Whitney, Division Niles, Bement-Pond Company.

Fig. 1. The blade root gage shown with the Air-O-Limit Comparator.

The blade root gage design incorporates a carbide roll-type anvil which is adjustable to accommodate various sizes of root forms. The gaging point, opposite the roll-type anvil, is a carbide ball point spindle which operates the single air nozzle. A carbide roll pressure shoe spans the gage point and provides positive location of the gage on the blade root during the gaging operation.

Fig. 2. The carrier gage shown with the Air-O-Limit Comparator.

G. E. Penny Pinchers

Sixty expert penny-pinchers are graduating from a school in common cents. The result may pare the General Electric Company's production costs millions of dollars a year.

The 60 men, from 38 departments in 26 G.E. plant cities in the United States and Canada, are qualifying as value analysts in an intensive 8-hour-a-day school conducted in Schnectady.

Formally called the Value Analysis Conference, the penny-saving program is a prelude to setting up units throughout the company's far flung plant system to extend the attack against production costs.

Value analysis is not new to the company, savings of millions of dollars a year already having been effected through clipping costs of production by pennies or fractions of pennies, but through the 60 experts now in school, the program will be spread out.

Value analysis, as it functions in General Electric plants, consists of taking apart manufactured products and studying them to determine where costs of production can be shaved without affecting quality. Maybe a change in the kind of a bracket will save only a penny, but if a million of the brackets are used in a year, a saving in the order of $10,000 may be realized.

The value analysts study every conceivable operation from design and purchase of materials to actual manufacturing. When a study is completed, suggestions are made to operating departments, which determine whether the suggested saving is feasible. About 80 per cent of the suggestions made by value analysts have been put to work.

Under the close scrutiny of Lawrence D. Miles, top value analysis expert in the Materials Services Department, General Electric has been using this penny-clipping method for several years, but Miles is seeking to have a value analyst in every purchasing office in the company.

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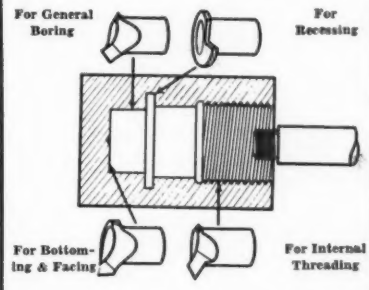
DETACHABLE HEADS



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Standard Length and extra long ½", ¼", ⅜" shanks

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ALSO—full sets in hardwood box, tool holders, and recessing tools for screw machines.

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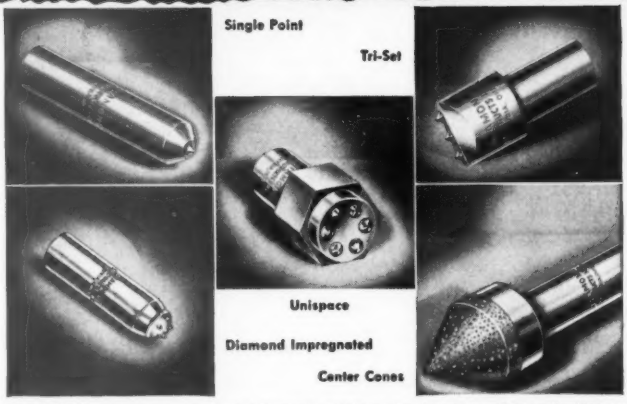

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GREATEST COST SAVER IN METAL CUTTING

Tremendous savings of time and money are effected in trimming formed parts with Tannewitz High Speed Band Saws, for not only are the cuts made exceedingly fast, and smoothly, but in most cases no jigs or rests of any kind are required. Sheets of both hard and soft steel, and even such metals as 1" armorplate are handled with great advantage by this method, and it is ideal for trimming malleable and steel castings. By all means get the complete facts and learn of the many opportunities for boosting production and lowering costs that Friction Sawing with Tannewitz High Speed Band Saws offers. Write for circular.

for trimming castings of all metals write for bulletin on "Foundry Band Saws".

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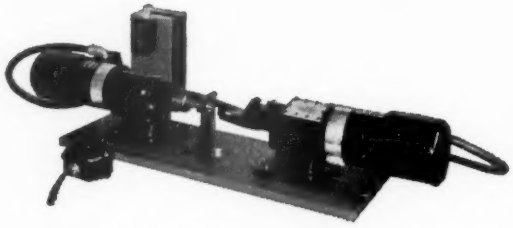
The TANNEWITZ WORKS GRAND RAPIDS MICHIGAN

STANDARD OPPOSED DRILLING MACHINE



THIS Standard Govro-Nelson Drilling Machine is supplied completely wired so that the two Automatic Drilling Units work simultaneously from a momentary contact palm or foot switch with a doweled hole for fixture location. (Fixture not included.)

With the Units adjustable endwise up to 18" between chucks, it can be used as a centering machine. By mounting a simple hand-index fixture, it can be used for drilling wire holes in cap screws. Two opposed holes can be drilled at once. A riser plate permits the drilling of offset holes.

Reduce Production Costs!

Why not drill two holes at the cost of one with this standard, versatile machine? Write for literature, sending samples and part prints.

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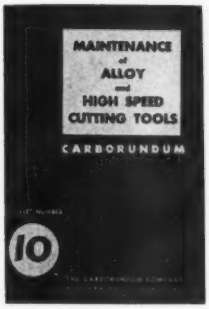
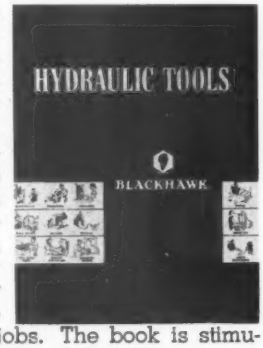
CARBORUNDUM PRESENTS:-

This very useful handbook, pocket size for shop convenience, on Safe Rules and Methods for Disc Grinding. Engineering drawings and tabular and typographical description clearly describe the following points: mounting methods; design and condition of steel as compared to abrasive disc wheels; mounting screws and studs; mounting procedures; storage of abrasive discs; speeds; care in handling and protective devices. The handbook is now available to our readers.
Circle Inform-A-Gram No. C1.



AND:-

This 72 page handbook, also pocket size, "Maintenance of Alloy and High Speed Steel Cutting Tools," again fully illustrated with photos, diagrams, and tables. Contents include: lathe and planer tool grinding; cutters and reamers—tool setups, reamer grinding, chasers, drills, taps and broaches, surface, cylindrical and internal grinding, and lapping—also sections on grading recommendations; coated abrasives; tool room sticks; and Carborundum "MX" products.
Circle Inform-A-Gram No. C2.



A Comprehensive Job-Picture Book is available for the first time showing how hydraulic tools can solve production, construction, maintenance and other problems. Featured are tested uses for "Porto-Power" remotely controlled hydraulic jack equipment, on pipe-benders, knockout punches, hydraulic pumps, torque indicators and hand tools which give the reader the benefit of ideas developed and successfully applied by hundreds of users of Blackhawk products. Much of the hydraulic equipment is relatively new to industry, savings are said to be frequently spectacular, and new safety and ease are introduced to many dangerous or difficult jobs. The book is stimulating and of value to a broad range of personnel through management, research, production fields. Write Blackhawk Mfg. Co., Milwaukee 1, Wisconsin, for your copy. **Circle Inform-A-Gram No. C3.**

This Tool Steel Selection Chart gives small shops a "Desk Drawer Metallurgist". It answers the questions of exactly what type of tool steel should be used for about 95% of all machine tool operations. It is an invaluable addition to the tool or die maker's tool box, designer's instrument set, and engineer's reference library. Makes accurate choice without metallurgical knowledge. Crucible Steel Co. of America, 405 Lexington Ave., N. Y. 17.
Circle Inform-A-Gram No. C4.

Instant and Positive Visual Checking of heat and temper colors is possible through a wide temperature range with a chart which may now be had by readers from the Bethlehem Steel Co., Bethlehem, Pennsylvania.
Circle Inform-A-Gram No. A5.

200 Page Tool Steel Handbook published by the Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa., has charts and tables, analyses and applications, heat-treat and handling techniques, plus complete weight table sets on a very comprehensive range of steels.
Circle Inform-A-Gram No. A6.

"Techniques Employed in Abrasive Belt Finishing" is title of valuable illustrated reprint with wealth of information now available from Porter-Cable Machine Co., Syracuse, N. Y.
Circle Inform-A-Gram No. C7.

Pocket Rivet Selector dials to any proposed size to disclose necessary clinch allowance, recommended assembly hole and rivet head diameters. From Chicago Rivet & Machine Co., Bellwood, Ill.
Circle Inform-A-Gram No. C8.

Rivet Drafting Template recently made available by Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif., conserves time in engineering departments. Quick drawing of Rivets at full or half scale, plan or side views.
Circle Inform-A-Gram No. C9.

Are You Connected with Purchase or Use of Diamond Tools? The brochure "Diamond Tool Engineering", from Maurice S. Dessau Co., Inc., Bank of Manhattan Bldg., 535 Fifth Ave., New York 17, N. Y., contains innumerable time-saving suggestions stimulating the production of speedy, top-quality work. Included are sections on selection of speeds and feeds and quality for a given job, correct adjustments, and care and handling of the tools.
Circle Inform-A-Gram No. C10.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

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DOUBLE DRIVE for equalized power
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√ Custom built to fit all lathes from 9" to 18".
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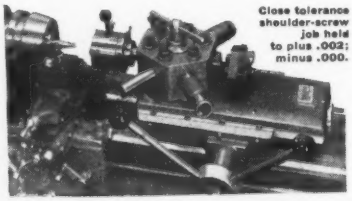
√ All bearing surfaces hand scraped.
√ All parts of indexing mechanism hardened, assuring accuracy.

Manufacturers of the most complete line of HEXTURRET BED TURRETS, TURRET TOOL POSTS, and TAILSTOCK TURRETS in the country.



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ENCO Manufacturing Co., Dept. 7102
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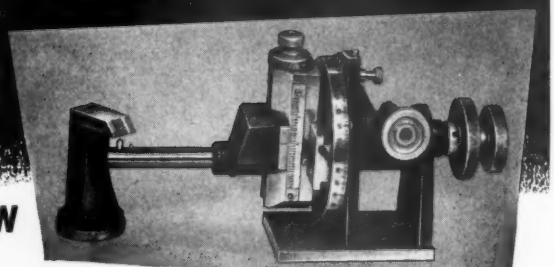
Set Up Angle-Tangent-to-Radius Forms
IN MINUTES
with the NEW



Now you can have precision within "tenths" and set up in *one-fourth* the time. Tangi-Matic has a direct-reading micrometer *built in*, eliminating "mikes", height gages, Jo Blocks *and errors*. Even novice operators obtain extreme accuracy. Tangi-Matic dresses any concave radius down to .032", full 180° with equipment we give you. Set-ups can now be made without removing dresser from your grinder chuck.

Our new model has *removable dressing arm*, permitting the use of extensions for dressing *large wheels*. Wearing surfaces are hardened, ground and lapped to a mirror finish, assuring you of years of extra service over ordinary dressers. Lead screw is hardened and ground to extreme tolerances. Furnished complete with master setting block, small radius attachment, plastic hood and carrying case. Write for literature and name of representative in your area.

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Conveyors Cut Assembly Costs

After over a year of operating a new assembly set up, the Spicer Manufacturing Division of the Dana Corporation has experienced a cut of approximately 50% in their transmission assembly costs. In this assembly set-up, a roller conveyor system was incorporated.

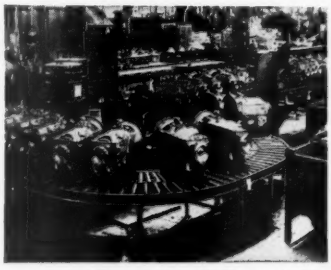

Photo courtesy E. W. Buschman Co.

Formerly, transmissions for trucks, busses and automobiles were assembled on benches and then moved by trucks between operations.

A unit turn-table in the line is one of the features which lends flexibility to the entire system. The unit turn-table is an integral part of the conveyor and serves to pick up the transmission assemblies for "turn-about". The flexibility of the roller conveyor facilitates model changes and new production items.

Gages—Root Form

Prior to the installation of this Air-O-Limit equipment, pitch diameters of fir tree root forms were checked by the relatively slow method of hand micrometers and thread measuring wires.

The carrier gage is designed to check the pitch diameter of the internal root forms in the jet engine blade carrier. The design incorporates a carbide roll-type anvil and carbide gaging roll. The carbide gaging roll is on a pivot arm which operates the single air nozzle. Both gages are set to minimum and maximum masters.

Installation of these small compact Air-O-Limit hand gages has proven to be a faster and more accurate method of checking these difficult pitch diameter readings.

Determining the Resistance of Steels to Heat Checking

In recent years many notable advances have been made in the art of permanent mold and die casting, drop forging, hot piercing, and extrusion, but the well-known die failure due to high temperature fatigue, also known as heat checking, still remains as a serious problem.

Similarly, many parts used at high temperatures, such as the parts of automotive, aircraft, and other internal combustion engines, and turbine blades, fail under thermal stresses or heat checks.

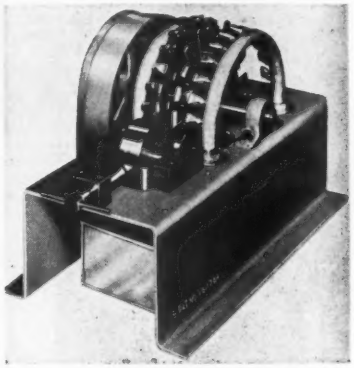

Photo courtesy Henry G. Keshian.

A thermo-testing machine has been developed which determines the relative resistance of different materials to heat checking. Test pieces are successively heated, stressed and cooled. This cycle of heating, stressing and cooling is repeated until the specimen develops visible cracks or heat checks.

The number of cycles required to produce heat checks are indicated on a counter attached to the machine. As many as eighteen test pieces can be tested at one time. The effects of various heat treatments, the range of heating and cooling, amount of pressure applied to the specimen and the effects of various alloying element on the resistance of steel to heat checking can be studied. Various materials used for molds, permanent molds, die casting dies, glass molding dies, drop forging dies, hot piercing mandrels, extrusion dies, hot rolls, etc., can be tested. The machine measures approximately 24" wide, 36" long and 18" high and is manufactured under U. S. Pat. No. 2611264.

"Looks like someone swiped another one of Pete's Columbia Molite Cutters!"

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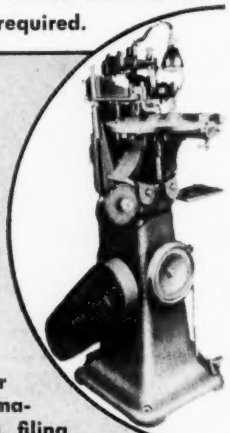
Toolroom Efficiency Increased . . . Precision Assured With OLIVER DIE MAKING MACHINES

Speedy and Accurate They Effect Savings in Time and Costs Up to 60% . . . yet they're so simple to operate skilled labor is not required.



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The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

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OLIVER INSTRUMENT CO.
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. . . Cost Controls, from page 123

November, six months later, the total budget for labor was $60,000, with a total excess cost of only 8% or $4,900; a reduction in excess cost from 30% to 8%, with a dollar saving of $11,800. In the following six months the excess cost was reduced to almost zero.

Foreman Conferences

Top management can do much to increase the effectiveness of the operating control system by holding personal conferences with the foreman whose reports indicate that he needs help. Low performance in practically every instance can be eliminated if the plant manager, industrial engineer, and foremen, work out the problem together and take the action indicated by the facts revealed.

In no case should top management consider these cost figures as a "big stick" with which to belabor the foreman, but rather as a system that pinpoints excess cost and waste, and as a means for applying corrective measures and following up the results.

. . . *Continued page 134*

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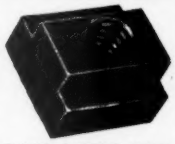

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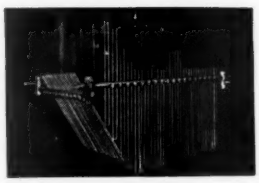

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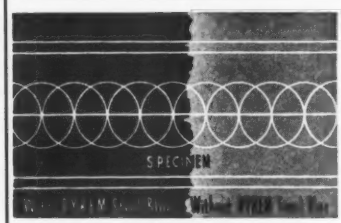

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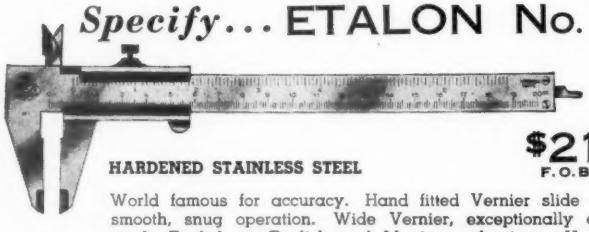

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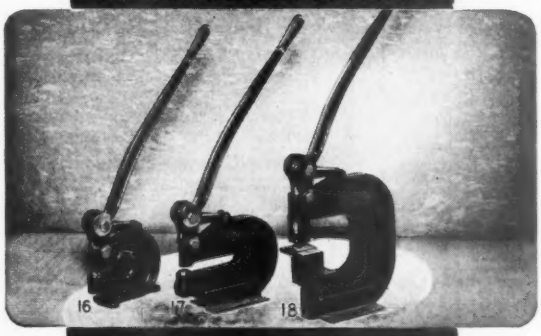

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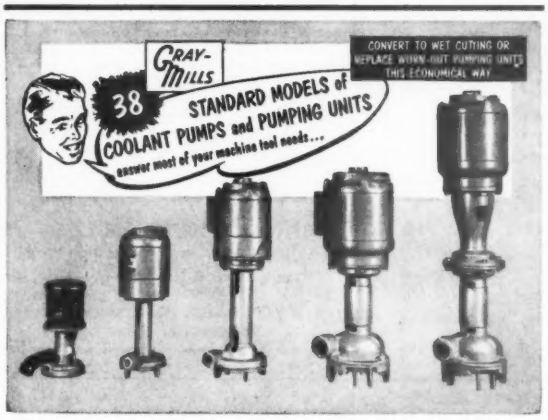
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A recently developed speed reducer features compactness and fully-enclosed driven gears. It is designed to operate efficiently on all types of drill presses and other machines using Vee belt drives.

The speed of the pully is automatically reduced 4½ times or 7 times, depending on the unit used, by simply turning a key at the top of the unit. This brings into play a positive gear reduction that works as a back gear. It is ruggedly constructed and being entirely self-contained, requires no mounting brackets.

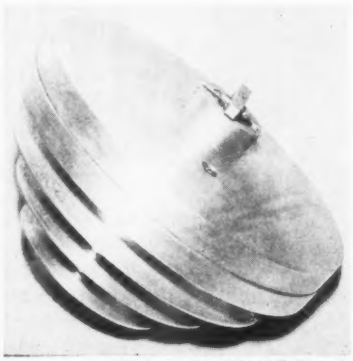

Photo courtesy The Pull-Gear Co.

Installation consists of simply placing the unit on the motor shaft and tightening a set screw. It will efficiently reduce the speeds of light type machinery without loss or waste of power.

The unit provides the correct speed and power on light type drill presses to: drill up to 1¼" in steel; tap up to ⅝" in steel; ream and bore up to 3" in steel; and spot face and counterbore on operations requiring slower speeds than normally obtainable on standard machines.

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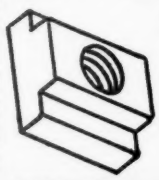

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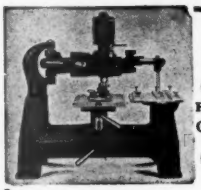

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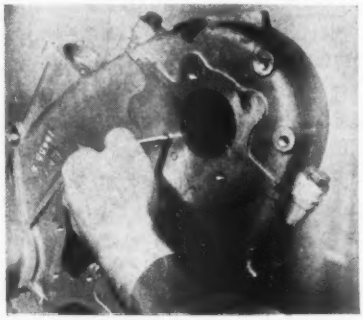
Helical Thread Inserts Boost Engine Production

Stainless steel wire thread inserts have solved two problems for the Fageol Products Company engineers at their Kent, Ohio, plant. First, through the use of the inserts, as liners for tapped holes in the vulnerable aluminum castings, production of Fageol's automotive and industrial engines has been increased by six per cent; second, by using the inserts



Photos courtesy Heli-Coil Corporation.

in relatively inaccessible tapped holes, service difficulties in the field have been sharply reduced.

Formerly, in these high-speed engines which range from 150 to 225 hp in output, such inserts were used only where periodic removal of inspection plates led to accelerated thread wear. More recently, aluminum parts were specified on 40 models of the company's six-cyinlder engines. The low-loading characteristics of threads tapped directly in this metal posed problems in both manufacture and maintenance: aluminum threads often were damaged in normal assembly, and became prematurely worn by regular removal of parts for inspection or adjustment.

By standardizing on stainless steel thread inserts the manufacturer has eliminated thread damage in assembly operations and thus has cut production salvage costs. Also he has completely shielded aluminum threads from wear in service.

At the same time, use of these inserts has overcome a serious service problem which might have resulted from the use of unprotected aluminum threads in places difficult of access. Such locations, on these engines, included the timing chain cover, which uses five 5/16-8 cap screws, and the distributor gear box, which takes two 3/8-16 inserts.

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High Speed Drills ... EXTRA LONG LENGTH

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21 to 30	5⅜	.80	5/32	12	9	1.65	21/64	12	9	2.50
31 to 40	5¼	.70	11/64	12	9	1.65	11/32	12	9	2.50
41 to 50	4½	.60	3/16	12	9	1.65	23/64	12	9	2.75
51 to 60	3½	.50	13/64	12	9	1.80	3/8	12	9	2.75
			7/32	12	9	1.80	25/64	12	9	3.05
			15/64	12	9	1.95	13/32	12	9	3.05
			1/4	12	9	1.95	27/64	12	9	3.30
			17/64	12	9	2.05	7/16	12	9	3.30
			9/32	12	9	2.05	29/64	12	9	3.60
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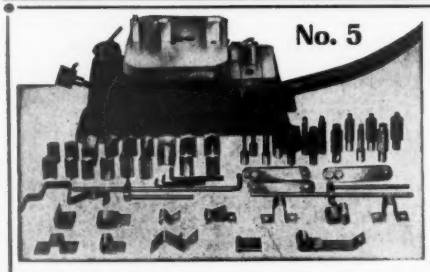

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. . . Cost Controls, from page 130

Summary

In general, wherever the Sheppard Plan of Operating Cost Control has been installed we find foremen actually welcoming it. The plan forms accurate "yardsticks" for foreman incentive plans, wage increases and advancement. It provides the foreman with a set of equitable standards plus a daily performance record against those standards, in terms he can readily understand. It flags abuses in every activity in his department quickly and efficiently so that the causes of the abuses can be readily corrected. It gives the foremen close control over his department and a sound basis for evaluating his own supervision, his productive and nonproductive employees, as well as the services rendered by others. He can watch his cost up and down the line and knows he is doing a good job and when not.

The plan provides management with an accurate evaluation at the foreman level. It indicates organizational strong links and weak links. It pinpoints abuses for management and indicates the corrective measures needed to end such abuses. It affords an honest basis of foreman evaluation for incentive programs or advancement and the overall plan can cut costs from 20 to 60% in departmental operations.

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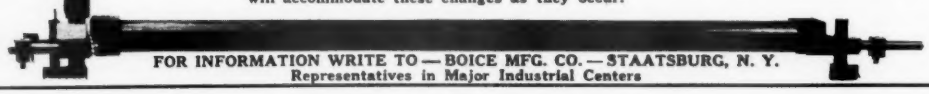

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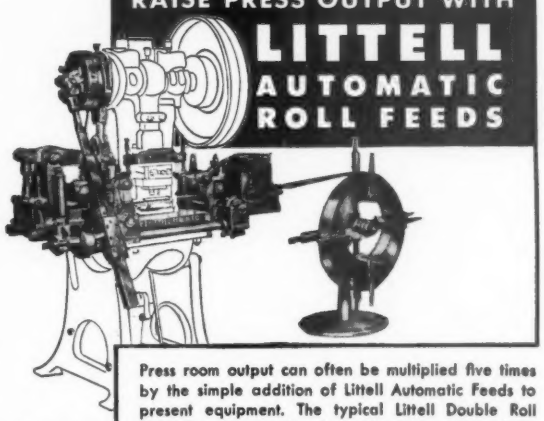
LITTELL AUTOMATIC ROLL FEEDS



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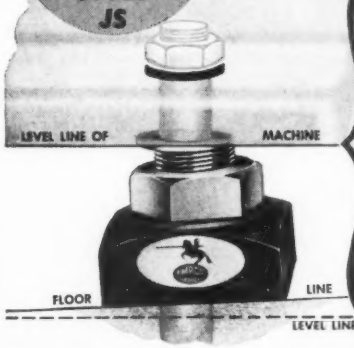
Empco JACK STYLE JS

NEW MACHINE LEVELING DEVICE



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ROTO HEAD Increases Engine Lathe Productivity

Designed to fit all engine lathes of 9" to 12" swing, the Roto Head is a newly developed accessory which serves to multiply small lathe production of duplicate parts.

It uses the principle of the Swiss-type automatic machines in that it embodies eight different single point tools mounted in slidable, spring-loaded tool holders. The tool holders are equally spaced around the face of a rotatable head, each tool feeding radially toward the lathe axis. The Roto Head is mounted on the cross slide dovetail, replacing the conventional lathe cross slide.

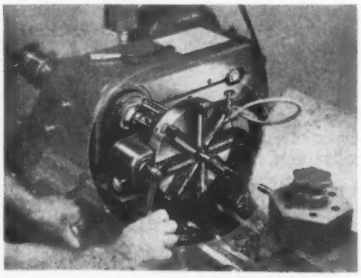


Photo courtesy General Roto Company.

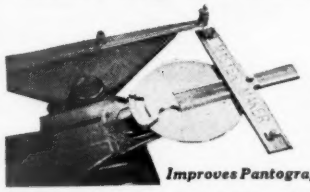
Individual tool infeed is activated by rotating a hand crank. A cam attached to the crank advances the tool to the cutting depth determined by either of two limit buttons behind the tool slide. Each button is equipped with a micrometer adjustment. Thus two diameters can be turned by each cutting tool. As the crank is rotated further, the head automatically indexes to the next station, the cutting cycle repeating successively with each tool slide. By varying the setups for the different tools, up to 16 different diameters can be produced on one job.

All longitudinal feeds are made by conventional carriage travel. For each working station, stops are provided which automatically index and limit the longitudinal feeds. These permit a total of 23 shoulder lengths plus cut-off.

The work is supported at the tool point by three universally adjustable rollers. Rigidity is so great that 1" bar stock (maximum capacity) can be reduced to zero in one pass.

Center drilling of the work is not required, and no tailstock support is needed.

Master Maker and Marking Device



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Precision work at any angle . . . Tracer control with rotary table performance . . . speed and accuracy assured . . . adaptable to all 2 and 3 dimensional engraving machines. Send for literature.

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Ever have a tap or drill break in an expensive part? . . . so that even careful drilling couldn't save it? Today, parts costing as little as 50c can be economically salvaged by an Elox Electron Drill.* They're real money savers! No plant can afford to be without one. Write for particulars.

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OF MICHIGAN
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Clawson, Michigan
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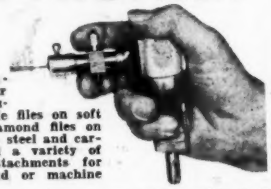
50% LESS HAND FILING and FINISHING TIME when you use the . . .

DI-PROFILER



The Di-Profiler uses regular needle files on soft steel, diamond files on hardened steel and carbide and a variety of other attachments for fine hand or machine work.

The Di-Profiler is a new triplel action tool that (1) Rotates (2) Oscilates (3) or Reciprocates by simple adjustments. Stroke is adjustable from 0" to ¼". Attaches to standard flexible shaft drive, yours or ours. High precision provides reciprocating action without vibration.

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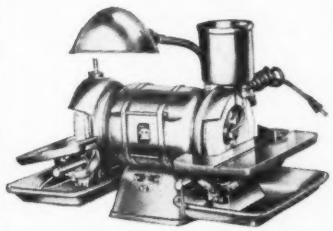

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Short wheel and bearing centers, heavy shaft, large ball-bearings, dynamically balanced armature and weight-balanced wheels provide rigidity and smoothness necessary for precision work. ½ hp, 3400 RPM reversible motor. $142.60 complete.

Mail this ad for Bulletin No. 341-B

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MODEL 50E

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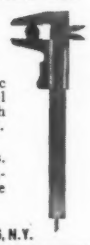
Guaranteed Accuracy



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OLD WAY

PO-RO CLAMP SUPPORT BLOCKS

½" to 10" height (in 1/16" adjustments) with one set of blocks.

HARDENED STEEL
TRUE FLAT SURFACES
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$11.75 PER SET CONSISTING OF

4—No. 1 half blocks— ½" to 1"
4—No. 2 half blocks—1" to 2½"
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PODLIN TOOL CO.

3918 Wesley Terrace, Schiller Park, Ill.

New Electric Furnace: Roller-Hearth Type

For the more rapid and easier heat treating of moderately large items or heavy loads, such as tools, dies, etc., a new electric roller-hearth furnace has been introduced. Although moderate in over-all size (42" wide by 48" deep x 75" high) it has a chamber size of 15" wide x 30" deep x 15" high and is provided with a roller

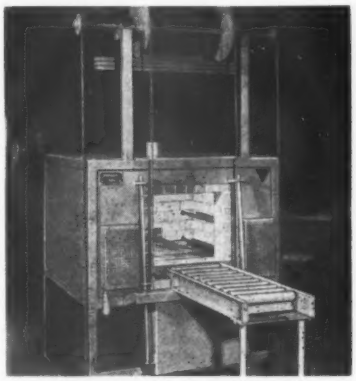


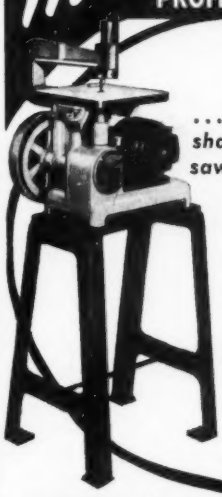
Photo courtesy Pereny Equipment Company.

extension or conveyor 36" long x 15" wide (working height 30"). The door is of the counterbalance drop type equipped with a roller mounted on the top edge, thus providing a continuous conveyor.

This new unit, is designed for normal operating temperatures of 1400° F. with a 1500° F. maximum. Current characteristics are 20 KW, 220 volts, 60 cycle, 1 phase.

Although it is a basic standard unit that is being added to the extensive line of the manufacturer it can be adapted to specific requirements by being provided with various types of heating elements and automatic temperature controls of all standard makes.

CUT TOOL AND DIE-MAKING COSTS WITH . . . Milwaukee DIE FILERS PROFILE GRINDERS



DIE FILERS

. . . for straight-line sharp corner filing, sawing and lapping

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

Write for illustrated Bulletins and Prices.

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. . . for high speed Precision Grinding of curved and Irregular Contours

Standard features include 20,000 or 30,000 R. P. M. spindle speeds, ½ H. P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser. Write for illustrated Bulletins and Prices.

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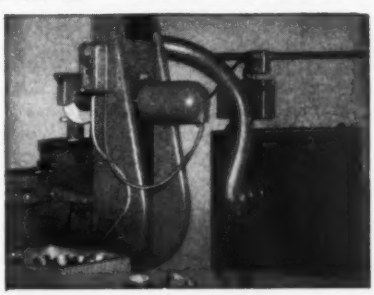
Available from stock of 22 standard models.

300 cfm to 10,000 cfm

Ask for Catalog 605-2. Describe dust problem for recommendation by return mail—No Obligations.



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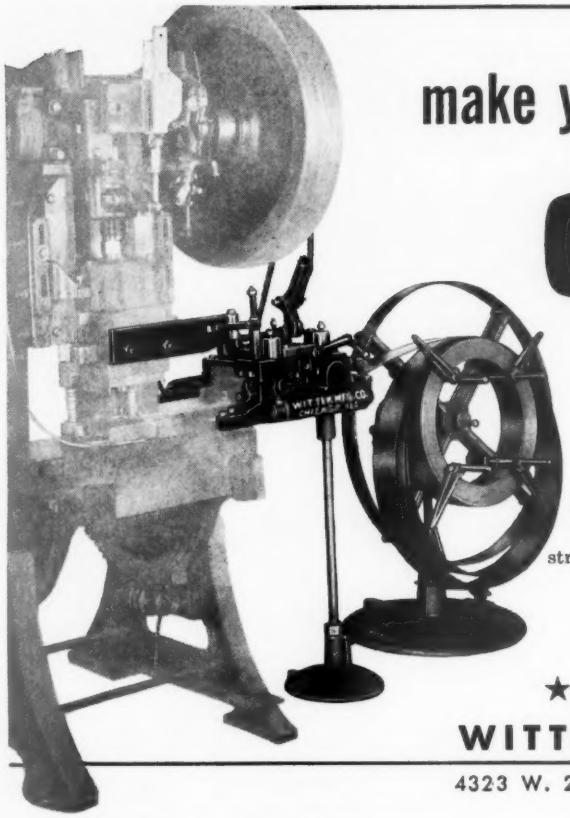
213 Main St. Ann Arbor, Michigan



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Wittek Roll Feeds handle any type of coiled strip stock and are made in single roll, double roll, and compound types with straighteners, in models to feed in any of four directions. They are reliable and accurate with simple, quick adjustment of feed length. Standard sizes and models meet a wide variety of press size and capacity conditions.

Wittek Reel Stands facilitate handling coiled stock.

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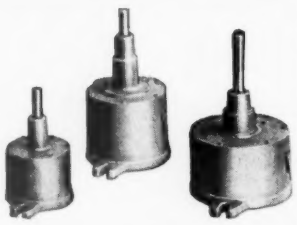
Automatic ROLL FEEDS AND REEL STANDS WMCo.

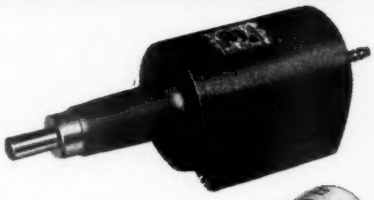
SINGLE-ACTING

Air-Clamp

*Air Cylinder



	STROKES	
Bore	Horizontal	Vertical
1"	5/8"	1"-2"
2¼"	1"-2"-3"	5/8"
3"		½"-2"
4"	2"-2½"	3"
5"	3"	3"
6"	3"	2"



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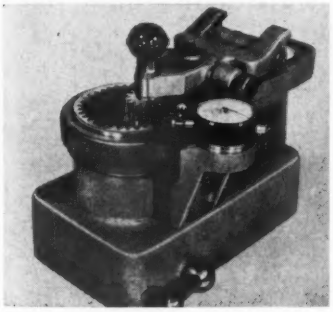
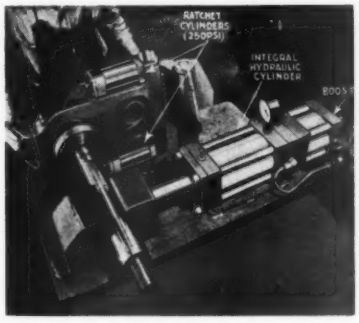
New Bench-Type Internal Gear Rolling Fixtures check size, eccentricity, smoothness, and face runout; are announced by the Michi-



gan Tool Co., 7171 E. McNichols Rd., Detroit 12. Known as the model 702 fixtures, they are made in three sizes for gears between 4" and 12" OD. Gears to be checked are loaded in a pot-type chuck mounted on vertical spindle. The master gear is swung into mesh by a lever controlled eccentric. Size, eccentricity and roll smoothness are indicated by a .0005" indicator while the chuck is rotated, and another .0005" indicator simultaneously shows face runout. Gear ejected by frontally mounted control lever.
Circle Inform-A-Gram No. A1.

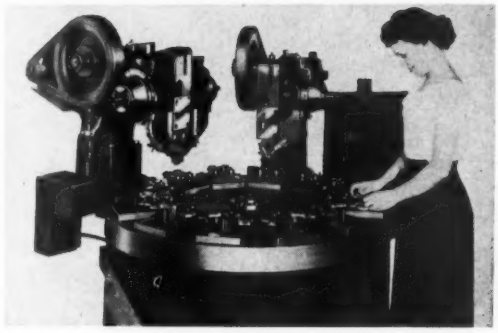
"15 Tons of Squeeze" is the clamping pressure developed by this assembly by Miller Motor Co., 2040 N. Hawthorne Ave., Melrose Park, Ill. A 5" bore fluid pressure booster unit drives a 5"



bore hydraulic cylinder, the piston rod of which operates the movable clamping member. In pictured application 2 small-bore cylinders permit instant locking and unlocking of the entire assembly.
Circle Inform-A-Gram No. A2.

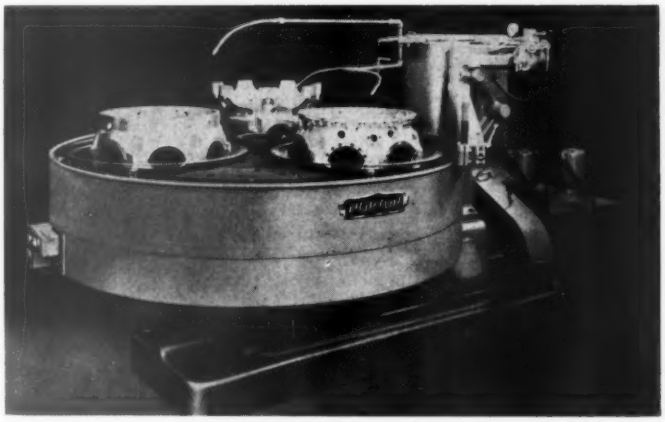
Model 4012 represents the most recent addition to a line of dial fixture automatic rivet setting equipment.

It provides greater speed in tubular riveting through simplification of loading and control of operator speed, also eliminates safety hazard in dealing with small or awkward parts.



This machine is typical of a line of units which may now be ordered job-engineered from Chicago Rivet & Machine Co., 9600 W. Jackson Blvd., Bellwood, Ill. Rotating dial fixture has 12 stations, is 40" in dia. Three tubular rivets are fed and clinched simultaneously, and operation is continuous. The operator can stop the machine by a foot-switch if she should make an error in loading. The rotation rate of the dial fixture may be controlled from 0 to 35 stations per minute.
Circle Inform-A-Gram No. A3.

Norton 60" Single Face Flat Lapping Machine. This new machine which is equipped with a 60" segmental type bonded abrasive lap, provides a superior means for lapping large parts. It is outstandingly efficient for lapping soft metal parts because it produces a clean, finished surface that is free from grit either embedded or trapped in pores or crevices, and because it produces this type surface in a minimum of time. This important advantage of producing a uniquely clean surface on soft metal parts makes possible the lapping of these

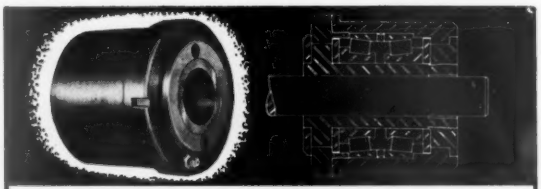


to produce seal surfaces, wear surfaces, or surfaces to be subsequently drilled or milled without an immediate cleansing of the parts after lapping to remove all traces of embedded abrasive. An additional advantage is provided by the bonded lap, which will produce bright surfaces without subsequent polishing. This advantage is pronounced where soft metals must be given a bright finish. A simple diamond truing operation at infrequent intervals maintains the high original machine accuracy throughout lap life. Norton Co., Worcester 6, Mass.
Circle Inform-A-Gram No. A4.

LEVIN®
MICRO-DRILL PRESS
for holes as small as .002"

Designed to hold small drills in precision collets. Absence of a sliding quill guarantees extreme sensitivity with finger-tip control. A mounted 1/8" capacity drill chuck can also be used.

Write for Bulletin H describing the Micro-Drill Press and listing collet sizes. Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles 21, California.



THE ONLY PILOT BEARING BUSHING WITH ABSOLUTE SEAL AGAINST COOLANT AND GRIT!

True—absolutely true—the Jergens Pilot Bushing provides complete sealing against abrasive grits and dust or other damaging materials entering into the roller bearing cavity. Amazing as it seems the entry of grit into the outer seal actually increases the effectiveness of the seal. Furthermore, this revolutionary bushing provides greater bearing accuracy—bushing stability and the first long lasting, complete seal in the roller bearing field.

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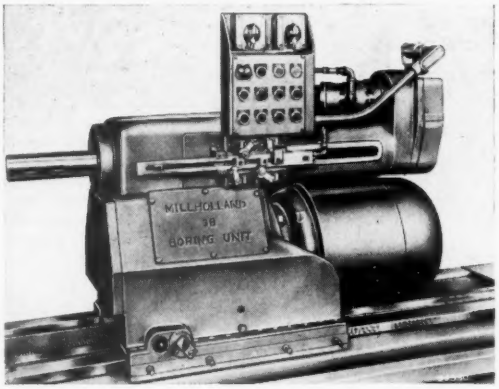
PERFORMANCE FEATURES
* Absolute seal against coolants, grit and dust
* Bearings can be dissembled without removing housing
* Cartridge - type bearing holder provides greater accuracy
* Protects against thrust loads as well as radial
* Tapered bearings can be adjusted to compensate for wear
* Adaptable to receive removable slip bushings
* Adaptable to receive keys or keyways
* Can be furnished with shafts to use as pressure rolls

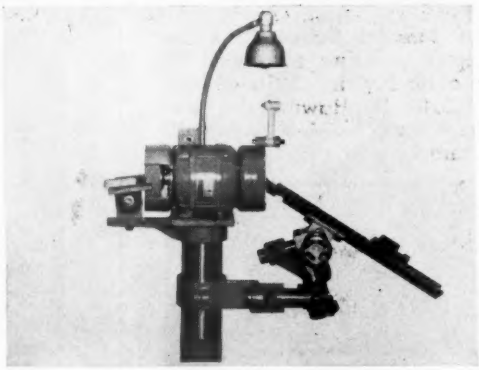
J. G. JERGENS CO.
11106 AVON AVE • CLEVELAND 5, OHIO

Improved Drill Grinder Features 1/8" to 2½" Capacity. The Sterling model D drill and carbide grinder by McDonough Mfg. Co., 1500 Galloway St., Eau Claire, Wis., does not use collets or chucks. The drill is located against the lip being ground to assure greatest accuracy and the adjustment for drill size is a simple one. The clearance angle may also be easily adjusted as required. A built-in diamond



wheel dresser is standard equipment. Automatic compensation for wheel wear is another new feature. A further advantage is that 3 and 4 lip core drills may also be ground without any change in the machine or any special fixtures. The necessity of preserving centers in core drills for grinding purposes is also eliminated. Full data is now available to our readers from the manufacturer.
Circle Inform-A-Gram No. A5.

3B Millholland Automatic Boring Unit is of fixed center horizontal type, offers ease and economy in many machining operations heretofore inaccurate impractical, or both. Condensed specifications include 5-10 HP; spindle speed 33-500 rpm by pick off gears; spindle diameter, 3"; No. 5 morse taper to spindle; 10" length of bar stroke. Features are stated

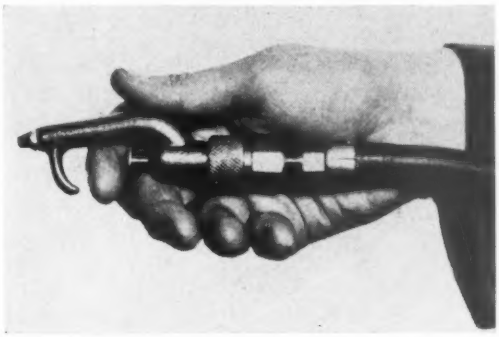


as follows: body in heavily proportioned box-ribbed semi-steel casting; spindle reduction drive full ball bearing mounted with ample gear tooth design to give a large safety factor; final drive through helical gears. Feed mechanism actuated by hydraulic pump and fluid motor driving through reduction gearing to the lead screw which in turn feeds the lead nut mounted in ball bearings at the end of the spindle. Combined automatic and Alemite lubrication, automatic cycling rotary positive stop adjustable in .001" increments. Full data from W. K. Millholland Machinery Co., 6402 Westfield Blvd., Indianapolis 20, Ind. **Circle Inform-A-Gram No. A16.**

Permanent Magnets in "You-Try-It Kits' are being marketed by Carboloy Dept. of G. E. Co., Detroit 32, Mich., to enable industrial planners to devise their own new uses for permanent magnets within their own plants. Carboloy; whose magnets have already found a wide use in such varied applications as recovering tools from liquid tanks, feeding sheet metal into presses, holding steel plates for painting, affixing models on plant layouts, and picking metallic waste from conveyor lines, believe that countless additional uses will be found when engineers have magnets at their own experimental purposes. Two

kits are available. No. 1 has 48 magnets in 8 styles, with up to two pounds "pull" for each unit. No. 2 contains 18 larger magnets, in four different styles. These have a "pull" of from 3 to 12 pounds. Shop package number one sells for $10, number 2 for $15. Literature is available.
Circle Inform-A-Gram No. A7.

"Tu-Flo" is New Air Blow Gun just announced by Supreme Machined Products Co., Spring Lake, Mich., having sound and desirable engineering features. A positive two-stage throttling action is provided, during 9/10ths the travel of which only a small volume of air is released. If the operator wants the full blast, he depresses the button all the way. He has a choice! Line pressure sealing makes the triggering easy and economical, leak proof because trigger sets against a pliant seat by airline pressure.



A ball bearing swivel is provided to eliminate kinking hose, making possible fast and easy movement. Together with this swivel, a built-in hook makes the blow gun quick and easy to hang in any convenient place without danger of kinking hose jerking the gun off the hook. Also the gun is so reinforced that it can be dropped, run over by a truck, etc., without damage. Extensions; ⅛", ¼", and ⅜" N.P. thread hose connections.
Circle Inform-A-Gram No. A8.

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Illustrating and pricing charts for every make and model of optical comparator and projector . . . radii, angles, American National, Unified-American thread form systems, Dry-seal and other taper pipe threads, protractors, comparator scales and comparator accessories.
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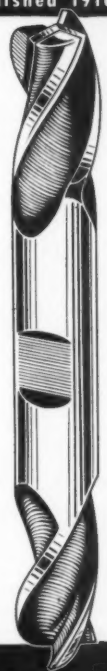

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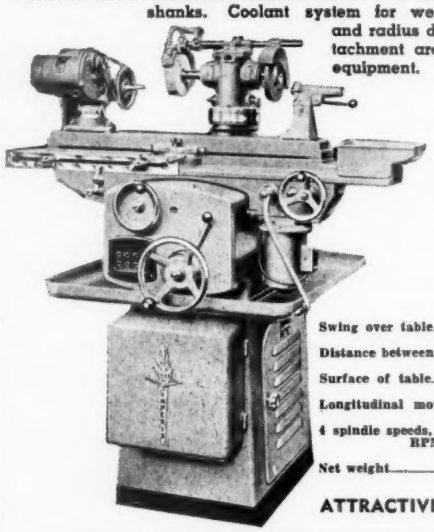
#2 IMPERIA UNIVERSAL TOOL & CUTTER GRINDER

Equipped with A.C. Motors and arranged for external and internal grinding with automatic table movement. Accommodates No. 50 National Standard and B. & S. No. 12 taper shanks. Coolant system for wet grinding and radius dressing attachment are standard equipment.



Swing over table ..... 10"
Distance between centers ..... 20"
Surface of table ..... 5"x32"
Longitudinal movement ..... 13¾"
4 spindle speeds, RPM—2900 to 5800
Net weight ..... 1,050 lbs

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to reduce costs and improve product quality

The statistical method of quality control will enable you to secure the best possible quality assurance from a given inspection cost. This book explains fully the use of this production-line technique in reducing the cost of spoilage and rework.

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HUEBNER PUBLICATIONS, Inc., 1975 Lee Road, Cleveland 18, Ohio

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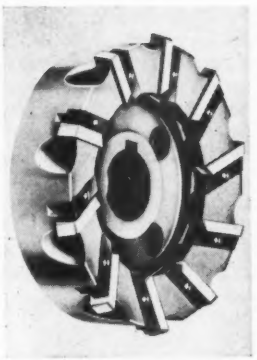
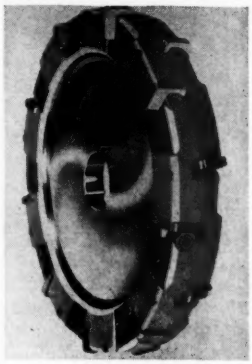
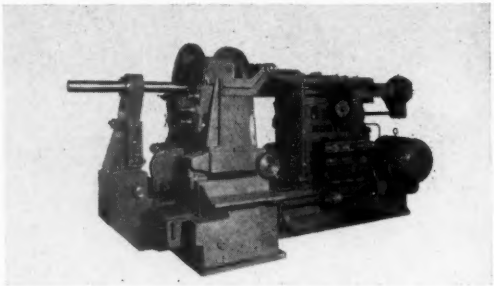


"IBH" Type Solid Carbide Inserted Blade Face Milling Cutter has only 3 parts; blade, wedge, and screw to be assembled with the steel body. The threads are in the wedge and not in the body so that in the event of accident, no damage is suffered by the body which can be quickly refitted Standards and specials. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. **Inform-A-Gram No. A9.**



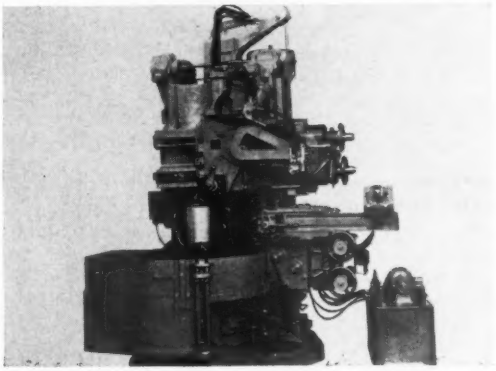
Staggered Tooth Indexable Solid Carbide Blade side milling cutters have been added to their Futurmill line by Detroit Milling Cutter Co., 28625 Grand River Ave., Farmington, Mich. Blades have ⅛" radius ground on each corner and when dull are simply indexed to one of the eight possible positions. Size maintained within .001" in all blade positions. Maker has all data. **Inform-A-Gram No. A10.**

This Morton Draw-Cut Shaper is especially designed for machining the rectangular tapered openings in forged or cast steel breech rings from 76 to 155 mm sizes. It has all the advantages of the regular Morton line on which literature is available. The ram is reciprocated hydraulically and has adequate capacity for taking heavy cuts at maximum feeds. An arbor within the ram provides rotary incremental feeds to the slotter bar which is made in sizes from 3" to 4½" diameter, depending on the rough opening size. A special cradle type fixture is provided having both horizontal and vertical incremental feeds and power traverse. The breech ring is centered in a spool type chucking ring which when placed



in the fixture can be rotated through 180°. The fixture is also provided with an eccentric operated mechanism which tilts it to the correct angle for establishing the proper taper for the non-parallel surfaces. Through the combination of rotative feeds to the slotter bar and with vertical and horizontal feeds of the fixture, also the ability to index the fixture through 180°, the breech ring can be completely rough machined in the inside of rectangular opening without removal from fixture. Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. **Circle Inform-A-Gram No. A11.**

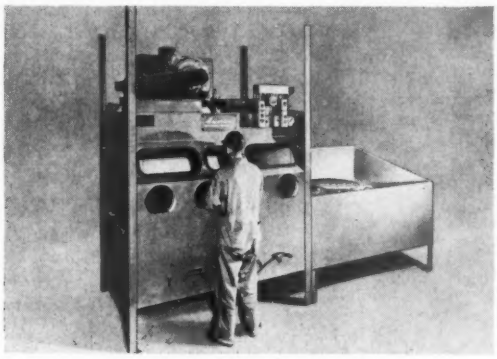
This Turchan Vertical Slide Hydraulic Duplicating Attachment applied to a Niles 42"/50" sidehead lathe is new development of particular interest to manufacturers of jet engine parts. The combination greatly increases the machine's contouring capacity. Hydraulically powered vertical slide gives infinitely variable feed rates plus rapid travel. Cutting tool is moved to produce the desired shapes on the work by means of the cylinder controlled by the contour



follower valve in contact with template. Micrometer adjustments permit accurate positioning of contour on workpiece. The 4-way turret tool block allows rough and finish cuts to be taken without altering adjustment of the follower, and grooving tools may be used in conjunction with the vertical slide; depth of cut being controlled by adjustable slide stops. Turchan Follower Machine Co., 8259 Livernois, Detroit 4, Mich.

Circle Inform-A-Gram No. A12.

New Model Wet-Blaster has just been added to the line of American Wheelabrator and Equipment Corp., 1183 S. Brykit St., Mishawaka, Ind. Known as the model 64 Liquamatte, it is intended for all precision finishing and cleaning operations involving large and heavy pieces. Typical applications include manufacture and maintenance of dies, glass, plastic and rubber molds; reconditioning plant engines, oil burners, etc.; surfacing tools such as long broaches, blending different types of finishes on aluminum; removing heat-treat scale and deburring.



The machine will handle loads to 3500 lbs., has two 49 x 36 inch counterbalanced doors and a 6' accessory tank to receive parts from blast chamber for rinsing. Many excellent design features make for speedy and accurate work. Among these are push-button control; automatic slurry agitation, recirculation and removal; plus cool interior lighting.

Circle Inform-A-Gram No. A13.

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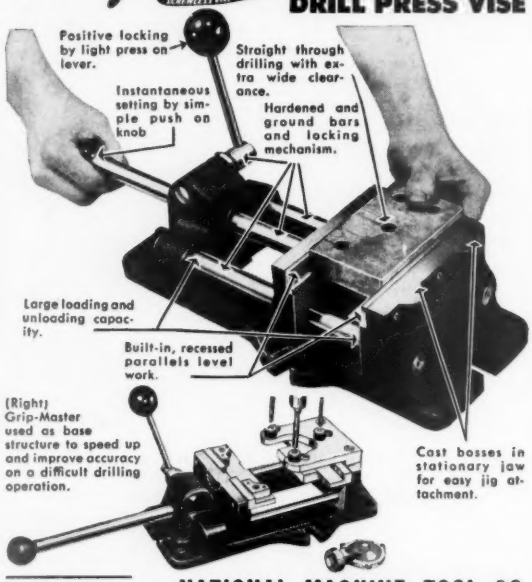
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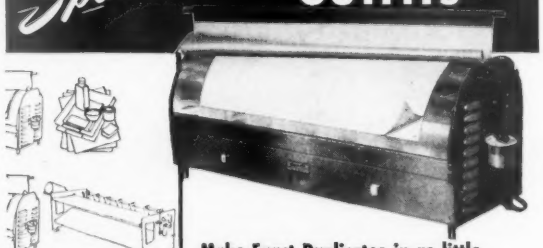

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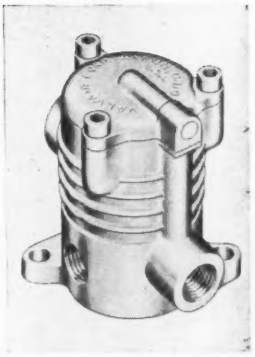
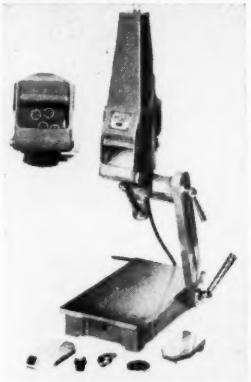
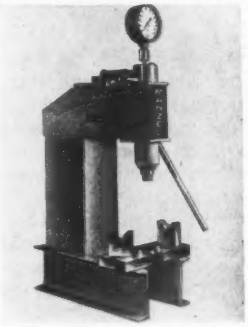


This New Solenoid Pilot Valve by Valvair Corp., 952 Beardsley Ave., Akron 11, Ohio, measures 3" in height, handles air, vacuum, oil, water, and inert gases. Body and cover high tensile zinc base alloy. Coil adaptable to continuous or intermittent service, is cooled by valve fluid or air but is completely sealed. 2-way and 3-way either normally open or closed. **Inform-A-Gram No. A14.**

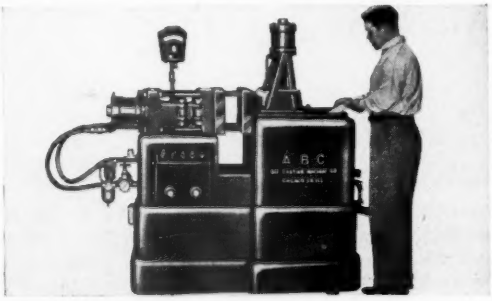


Direct Squareness/Parallelism Reading is given by this new "Projection Angle Dekkor" by Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. Instant checking of such jobs as squareness of holes to reference surfaces, parallelism of two or more bores or planes, etc., on production basis. A number of surfaces may be inspected simultaneously. **Inform-A-Gram No. A15.**

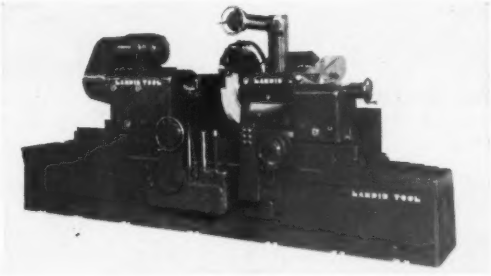


New Bench Type Arbor Press developed by Manzel, 315 Babcock St., Buffalo 10, N. Y., has 10 ton capacity and wide use range in tool room, laboratory, or machinery overhaul department. Straightening, material testing, bending, bushing, or bearing removal and replacement, etc. Vee blocks and bearing plate standard. **Inform-A-Gram No. A16.**

This New 1½ Lb. Zinc Machine has been added to the range of die casting machines of the A B C Die Casting Machine Company, 339-41 West 112th Place, Chicago 28, Ill. Some of its outstanding features are an electronically controlled panel; 10 x 10 x 2½ inches die blocks; four tie bars and semi automatic cycling with adjustable timing dwell on opening and closing of the toggle. This machine is air operated and is capable of free cycling in excess of 1000 shots per hour. **Circle Inform-A-Gram No. A17.**



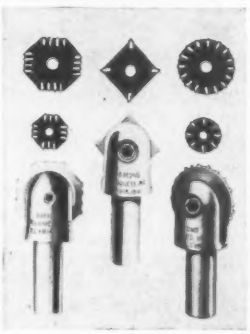
Landis Plain Grinder for Large Diameter Work. A new line of plain grinders for large diameter work has been developed by the Landis Tool Co., Waynesboro, Pa. Identified as the CHW plain grinder, it is available in 30", 36", and 48" diameter swings. Lengths between centers are 48", 72", 96", and 120". Parts such as turbo-jet engine rotors, track carriers, large diameter motor armatures, water valves, etc., may readily be handled. A 10 or 15 HP motor is used to drive the 30" diameter grinding wheel. Selection of the size drive motor depends on the type job to be ground. Variable speed headstock drive is standard, but constant speed is available. The slide under the wheelhead is a double type



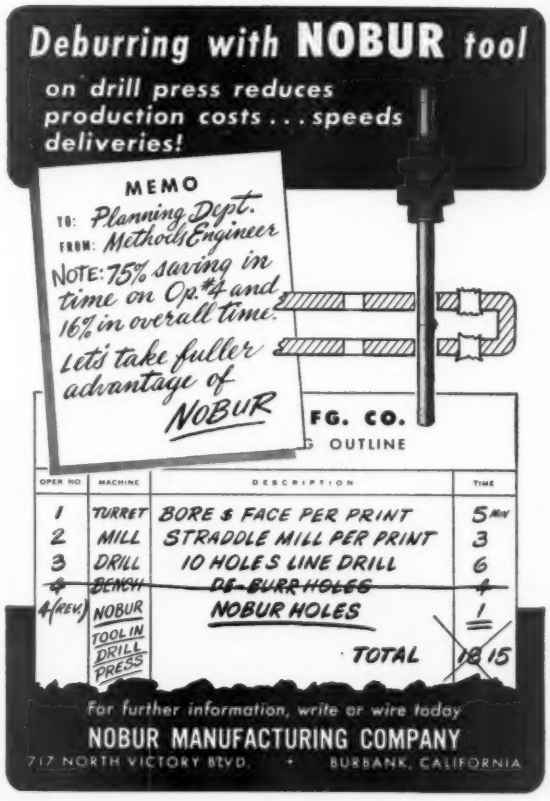
to allow for the large amount of base movement required on machines of this type. This slide is manually positioned, but can be supplied with power operation. Both slide and work carriage ways are pressure lubricated with filtered oil from a separate reservoir. Carriage ways have increased spacing to provide stability necessary. The hydraulic table traverse is adjustable to any desired speed between 3 and 130 inches per minute. The swivel table may be adjusted to grind tapered work. The wheel spindle runs in Landis Microsphere bearings. These bearings have a spherical outer form, are babbit lined, one piece steel bearings which may be quickly and easily adjusted for clearance. They operate with extremely small clearance between spindle and bearing, giving an accurate response to wheel feed changes as well as a quick, positive, spark-out. Eye level wheel feed, a Landis feature, is used for the adjustment of wheel head position. This enables the operator to watch the grinding clearance from the same position from which he adjusts the wheel. Eliminated are all extra movements which increase fatigue and slow set-up.

Circle Inform-A-Gram No. A18.

New Prestalloy Profile Diamond Dressers. Manufacturer of this new line is Diamond Products, Inc., 326 Prospect St., Elyria, Ohio. Every type and size of grinding wheel in use today can be dressed with these tools, which may be used either horizontally or vertically. Application is for straight, form, and profile dressing on centerless, cylindrical surface and integral grinders. No setting needed.



Inform-A-Gram No. A19.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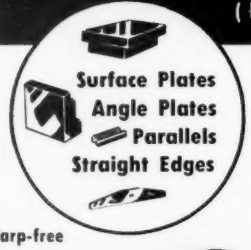

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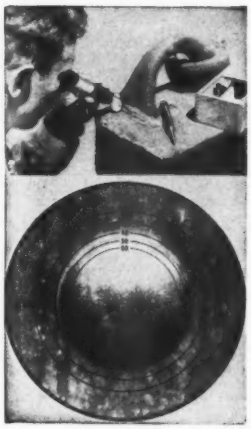
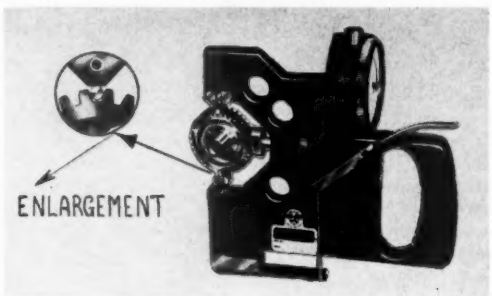


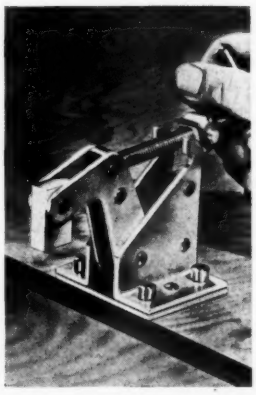
Portable Pocket Hardness Tester, low-cost and new has been designed by Pacific Transducer Corp., 11921 W. Pico Blvd., Los Angeles 64 for metals hardness testing from 25-65 Rockwell C. Portability and direct reading combined make the unit particularly fast in operation. Indentation diameter of a tungsten carbide ball is measured by a reticulated microscope, reading accurate to ± 1½ points "C". Field, plant, and sales engineers.
Inform-A-Gram No. A20.

This New Nilco Dial Gage has been designed to check pitch diameters of gears and splines or any other over-all measurement. Because of rotary cam principle there is no lost motion between gaging anvil and indicator. Floating rolls—**inset**—simulate

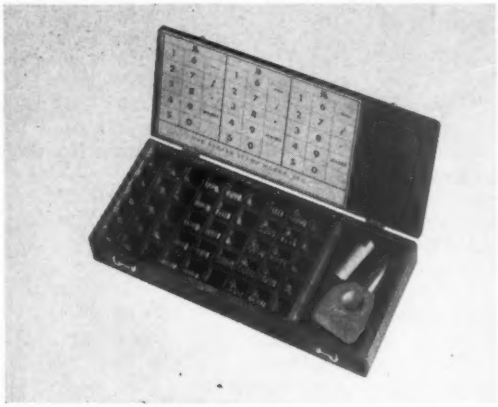


standard over-roll measurements with the rolls as gaging points. This free-floating feature results in true pitch diameter reading. The anvils are also removable and interchangeable, to allow checking for wear or for replacement by larger or smaller rolls as needed. The gage may be used at the machine or in inspection, is equipped with a .0001" indicator, gives instant accurate reading whether or not the operator is particularly skilled.
Circle Inform-A-Gram No. A21.

This Quick Acting Fixture Clamp is ideally suited to all drilling, milling, riveting and assembly fixtures. Full open position gives unobstructed vertical clearance for work entry and removal, and design gives great gripping power and non-flex characteristics. Clamping and adjustment are combined in one operation. Another feature of the clamp is the unique screw operation, which, together with the vibration absorbing spring bearing trunnion assures a firm steady grip in riveting or other abusive fixture operations. Centinela Industrial Supply Co., 11930 Inglewood Ave., Hawthorne, Calif., for all data.
Inform-A-Gram No. A22.

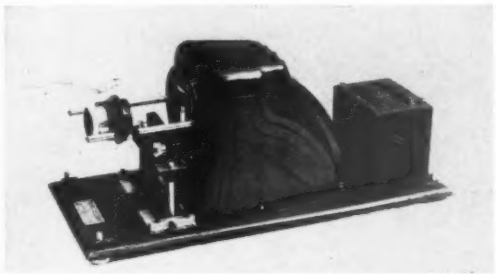


New Holder and Interchangeable Steel Number and Letter Sets promise increased marking versatility, have recently been introduced by Parker Stamp Works, Inc., Franklin Ave., Hartford, Conn. Flexibility is assured since hand or press stamps for any job and material can be set in seconds. Each set includes a variety of standard size letters carefully selected to provide maximum utility. An inter-



changeable threaded shank is provided with each set, allowing instant changes from hand to press stamps. Painstakingly made by craftsmen with years of experience, sets are available in a number of different sizes with varying combinations of letters, numbers, or letters and numbers. Each comes with durable hardwood case to facilitate easy, safe storage. Full information from maker.
Circle Inform-A-Gram No. A23.

This New Optical Magnifying Device, called the "Inspectoscope", is designed for the inspection of tools, gauges, and other mass-produced components and is introduced to the American market by International Standard Trading Corp., 22 Thames St., N. Y. It may also be used in the projection of 35mm film, 2" x 2" slides and micro-slides. Overall dimensions are 19½" x 9½" x 8", weight approximately 20 lb., wrinkle enamel finish. Objective lens is a 3" focal length, hard-coated anastigmat f3 which provides magnification up to 50x. The instrument



has a rotating head for the vertical and horizontal projection of film, and is equipped with a 200/240 volt AC transformer. Although the unit has a field one-half inch in diameter, work up to 1 inch can be accommodated. The magnifier may be employed in toolroom and machine shop with excellent results. Tool setters using the device can set up on "first-off" components with complete confidence. They can check cutting tools for angles, radii, rake, clearance, etc., against the component drawing before use.
Circle Inform-A-Gram No. A24.

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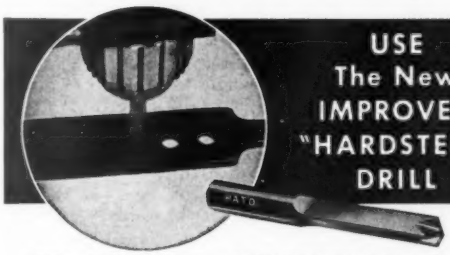

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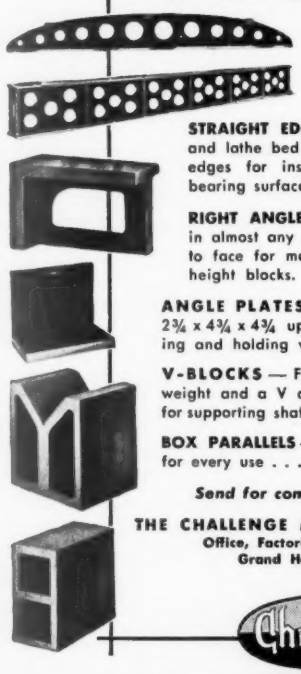

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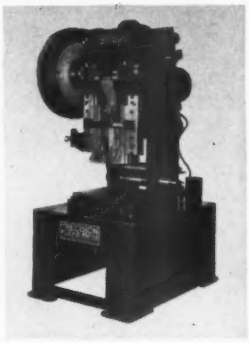
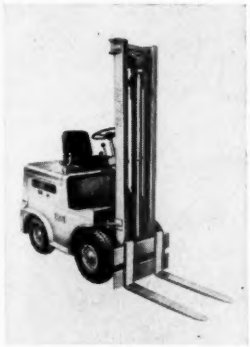
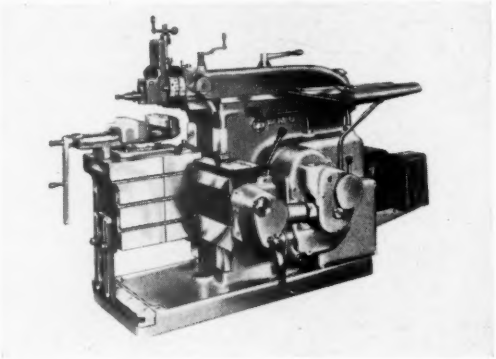


The New Model C-30 Flexopress. This machine has just been developed by Precision Welder and Flexopress Corp., 138 E. McMicken Ave., Cincinnati 10, Ohio. The many new features include integrally built feed rolls; alloy ram and connecting link weighing approximately 35% usual; ball bearing ram slide; and speeds from 110 to 450 strokes per minute.
Inform-A-Gram No. A25.

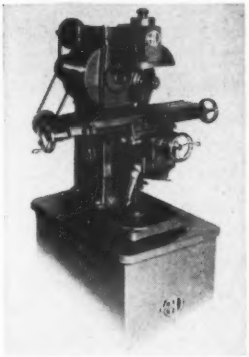
Improved Yardlift "20" Fork Truck announced. Clark Equipment Co., Ind. Truck Div., Battle Creek, Mich., recently announced this 2000 lb. capacity model which has twin double-acting tilt cylinders for smooth tilt action and upright stability. Other features now incorporated include centralized instrument panel, new quick-change clutch, and Elliott-type steering axle.
Inform-A-Gram No. A26.



CMC Rapid Traverse Pattern Crank Shapers highlight improved and simplified construction. Capacities of the machines comprising this line range from 18" to 36" stroke. A single lever controls the feed and rapid power traverse engagement and direction of table movement, horizontally and vertically. Power down feed to the head is regularly furnished on these machines. Some of the other features are: built-in transmission with heat-treated, precision shaved alloy steel gears with 8 speeds to the ram; Timken roller bearings in transmission and drive pulley; constant reading stroke indicator and feed

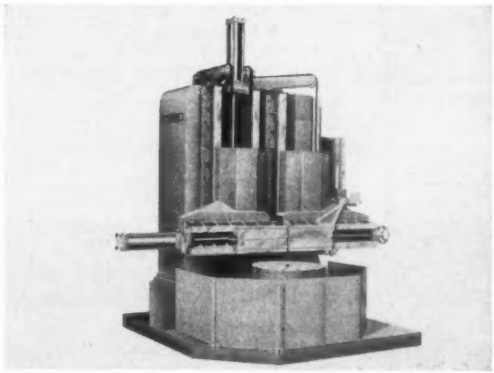


dials; automatic lubrication to transmission and feed; rapid power traverse of table, horizontally 100 inches per minute and vertically 50 inches per minute if the latter is ordered. Extra ruggedness results from the incorporation of double bullgear construction, providing long life to the drive, and through the bullgear bearing being cast integrally with the column. Pitnam Ind. Products Co., 608 Fifth Ave., New York 20, N. Y.
Circle Inform-A-Gram No. A27.



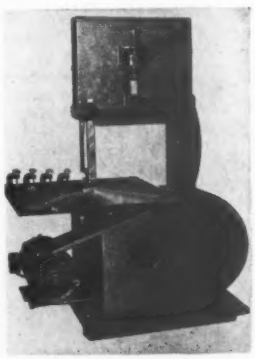
This New Compact Bench Mill by Rotex Punch Co., 4726 E. 12th St., Oakland, Calif., has enough rigidity and sturdiness to mill work requiring a 12" in length, 9" vertical and 5" traverse travel on its 5" x 20" table surface. Large diameter spindle with No. 10 B&S or No. 4 Morse taper operating at 15 separate forward or backward speeds, 3 speed work power feed.
Inform-A-Gram No. A28.

Ex-Cell-O Vertical Precision Contouring Machine for Production Work. Style 426-A, was designed to machine quickly and accurately such large round parts as jet engine compressor wheels. It performs such operations as precision contouring, boring, facing, turning, grooving, and rabbeting. Simple controls and automatic functions make it possible for an unskilled operator to turn out accurate production work. A tracer carried on the horizontal member of the right hand compound slide controls both vertical and horizontal movements in contouring operations.



Both vertical and horizontal members of the contouring slide are operated by ground lead screws driven by adjustable variable speed motors. Electronic control keeps adjusted feed per revolution constant regardless of contour or table speed variations. Seven different automatic cycles are possible with the left-hand compound slide. Normal machine cycle includes operation of both compound slides in sequence, either one first. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich., has all data.
Circle Inform-A-Gram No. A29.

This Sheet Metal Saw is new and improved heavier model with all cast frame by Brett-Marr Mfg. Co., Hopkins, Minn. Added weight assures utmost in stability and accuracy and reduces vibration to minimum. It will cut 50 to 70 stacked galvanized sheets at speeds to 15" per min. Quickly adjustable blade speeds from 125 FPM—2200 FPM for wide work range.
Circle No. A30.



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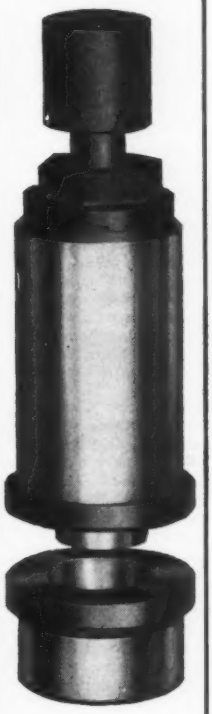

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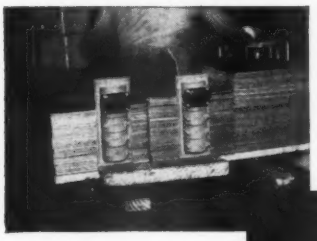

Left—12" Sheet Floaters used on rectangular sheets.

Right—6" Sheet Floater used to separate blanks.

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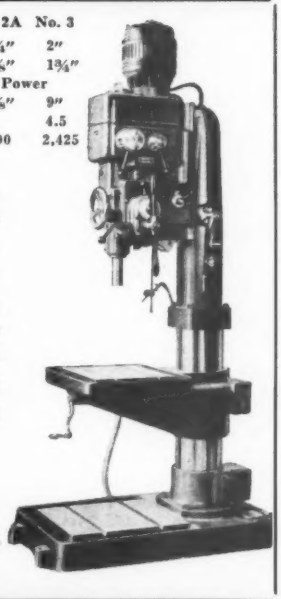

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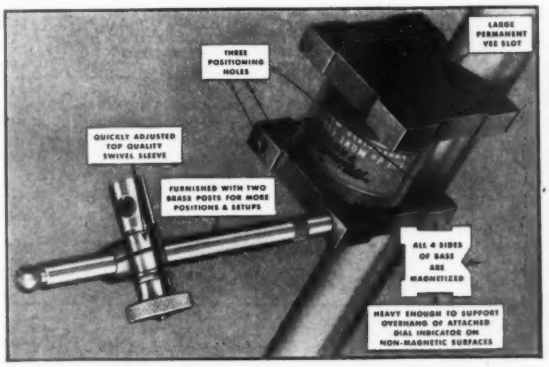
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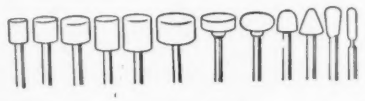

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2.	5/8"	x 1/2"	6.	1"	x 1/4"	10. A-41	5/8"	x 5/8"
3.	3/4"	x 1/2"	7.	3/4"	x 1/4"	11. A-111	7/16"	x 11/16"
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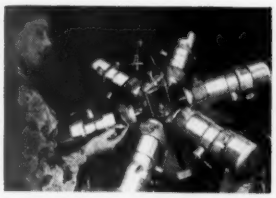

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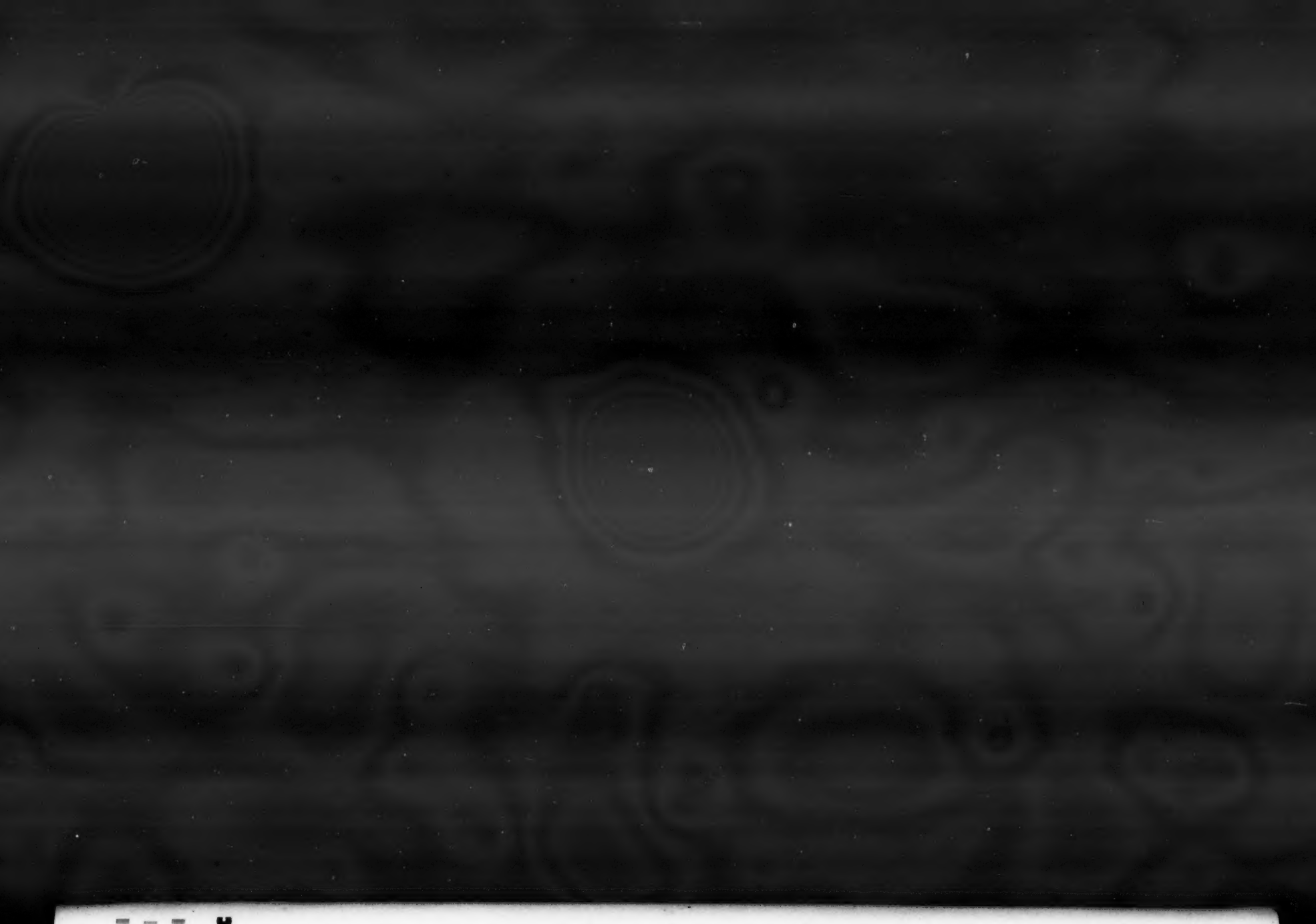
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